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THE PEOPLE'S FARM AND STOCK CYCLOPEDIA


EMBRACING

FARM STOCK IN ALL ITS DEPARTMENTS, INCLUDING THE BREEDING, CARE,
AND MANAGEMENT OF HORSES, CATTLE, HOGS, SHEEP, POULTRY,
BEES, ETC. ; FOODS FOR ANIMALS ; BARNs AND BARN-YARDS ;
THE DISEASES OF HORSES AND LIVE STOCK,

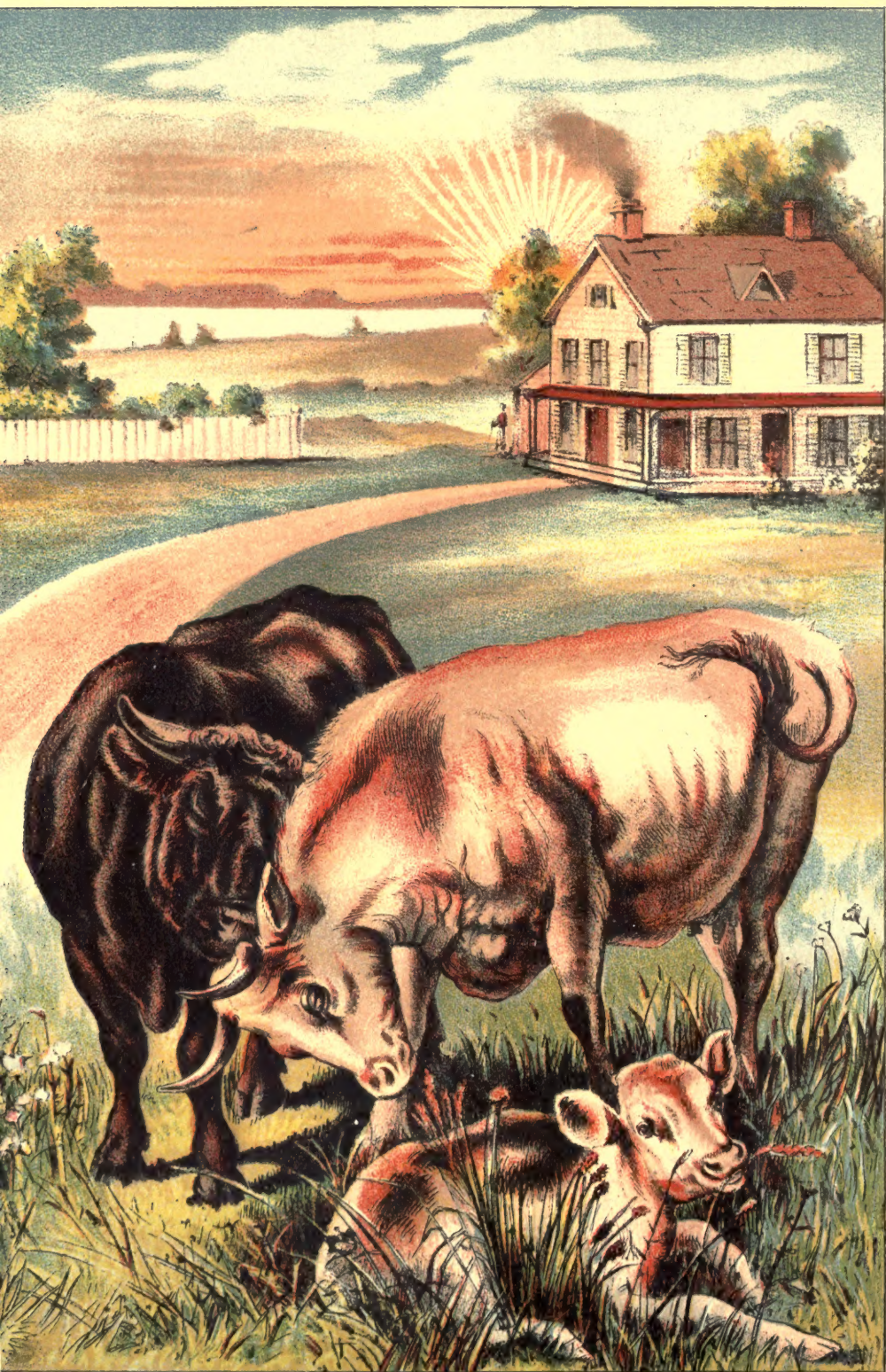
WITH NUMEROUS APPENDIXES

INVALUABLE FOR

REFERENCE IN ALL DEPARTMENTS OF AGRICULTURAL LIFE.



VOLUME I



CONTENTMENT.

THE PEOPLE'S FARM AND STOCK CYCLOPEDIA

EMBRACING

COMPREHENSIVE AND PRACTICAL TREATISES ON
FARM TOPICS OF EVERY DESCRIPTION,

INCLUDING

FARM MANAGEMENT; FENCING; FARM DRAINAGE; FERTILIZERS; THE SOIL, AND ITS IMPROVEMENT; GRASSES; CORN; WHEAT; MISCELLANEOUS CROPS OF EVERY DESCRIPTION; ROOT CROPS; FRUIT ON THE FARM; GARDENING; INSECTS; TIMBER-GROWING; FARM HOMES AND SURROUNDINGS; SMALL FARMS FOR POOR MEN; HANDY THINGS ABOUT THE FARM, ETC.

TO WHICH IS ADDED

A COMPLETE VOLUME ON FARM STOCK IN ALL ITS DEPARTMENTS, INCLUDING THE BREEDING, CARE, AND MANAGEMENT OF HORSES, CATTLE, HOGS, SHEEP, POULTRY, BEES, ETC.; FOODS FOR ANIMALS; BARNs AND BARN-YARDS; THE DISEASES OF HORSES AND LIVE STOCK,

WITH NUMEROUS

APPENDIXES INVALUABLE FOR REFERENCE IN ALL DEPARTMENTS OF AGRICULTURAL LIFE.

TWO VOLUMES IN ONE.

By WALDO F. BROWN,

Late Agricultural Editor of the *Cincinnati Enquirer*; Author of "Success in Farming," "Highland Farm Papers;" Contributor to the *Rural New Yorker*, *Country Gentleman*, *New York Tribune*, Etc.

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PREFACE.

WHEN I began the preparation of THE PEOPLE'S FARM AND STOCK CYCLOPEDIA I asked myself the question, Why add another to the multiplied list of books already written on farm topics? I was aware that the ground had been thoroughly covered. We have books on all the special departments of the farm; agricultural cyclopedias, and books on agricultural chemistry, botany, and other sciences with which the farmer needs more or less to be familiar. Many of these are of great value, and should be found in the library of every intelligent farmer; and it is not my purpose or expectation to produce a book that will supersede them.

There is one fact connected with our agricultural literature which has led me to undertake this work, and that is that few books have been written by practical farmers. Farmers as a rule are too busy to write books, particularly in their younger days, and after years of labor have stiffened the muscles few of them ever take up the pen to record their experiences for the instruction of their fellow-laborers. This was my own experience, for up to the age of forty I had never written a line for publication. Beginning life on the farm with no capital, and dependent on my hands for whatever of success I might attain, I had no time to write of what I was doing. During these years I was impressed with the fact that the farmer, isolated as he is, often learns from experience, obtained at great cost of time and labor, that which perhaps a neighbor could have told him, and a single item in an agricultural paper has often been worth to me many dollars; but still oftener I have, after years of experiment and costly failure, settled some simple fact and been led to exclaim, Why could not some older and more experienced farmer have told me this?

A little more than ten years ago I wrote my first article for publication. I began writing of the daily experiences of farm life, sometimes telling that which I thought would be helpful to others, but oftener asking for information which I stood in need of. These articles, under the title of "Highland Farm Papers," were continued for many years, and were received with such favor by their readers that the work of writing for the agricultural press grew on my hands, and during the past three years I have been constantly employed in writing for the leading agricultural papers both East and West. In 1882 I published a book of 250 pages, entitled *Success in Farming*, which met with favor and reached a third edition within ten months. It will readily be seen that the present book is a natural outgrowth of the labors and thought

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of the past ten years. It is pleasant to me to know that I do not come as a stranger before the farmers of America, as my writings have rendered my name more or less familiar to them in all parts of the Union, while in a narrower circle, including my own State and the border counties of Indiana, Kentucky, and Pennsylvania, I have had the pleasure, at fairs and farmers' institutes, of meeting and addressing thousands of the more progressive farmers.

It seems to me to be a propitious time to bring out a book of this character, for there is no question that the old prejudice against "book farming" is fast disappearing, and that the more intelligent farmers fully recognize the truth that a record of experience given through the medium of the press to tens of thousands, is none the less true than if spoken to a neighbor, and that the good it can do is thus increased infinitely, and that when printed in a book, so that it can be preserved and referred to, its value is much greater than if it was only in the paper which is soon thrown aside and lost. Our agricultural interests are so varied, and the subject is so vast, that no one man can be expected to understand or excel in all the branches of farm management. Recognizing this, I have availed myself of the assistance of others, whose contributions will be found valuable in their various departments.

All my life has been spent on the farm. Its trials and hardships as well as its compensations are familiar to me, and there is no work that I feel to be more useful or honorable than to write that which will help the farmer in his calling. It is on the farm that the habits of industry and hardy endurance are formed which fit our young men to enter the struggle of life and win its prizes. And just as our cities must, at whatever cost, bring a supply of pure country water for the use of their inhabitants to prevent contamination, disease, and death, so there must be reared in our country homes those who are to take the prominent places in the world's history and repair the moral waste of the cities. In some great emergency of a nation how often has God put honor upon country life by selecting from it a leader for the people. Moses, though learned in all the wisdom of the Egyptians, must spend forty years as a keeper of sheep in the wilderness before he was fitted for his great work. David was taken from following the sheep, Putnam and Washington from the plow, and Abraham Lincoln from the humble cabin, and all these were called to labors and honors which fall to the lot of but few.

The rain which falls on the barren mountain is not wasted, but by it are fed the perennial springs which flow through the valleys, bringing verdure and life, and the mighty rivers which float the commerce of a nation. So in the isolated homes of the farmers are being reared the men and women who are to help the world on towards the fulfillment of a grand destiny.

W. F. B.

CONTENTS.

PART I.—THE FARM.

CHAPTER I.

GENERAL FARM MANAGEMENT.

Selection of Farm.—Condition of Soil and Improvements.—Water Supply.—Roads.—Farm Products.—Rotation of Crops.—Amount to Cultivate.—Capital.—Hired Help, Pages 17-33

CHAPTER II.

FARM FENCING.

How to reduce the cost of Fencing.—Hedges.—Live Fence Posts.—Post and Board Fence.—Wire Fence.—Portable Fences.—Self-supporting Truss Fence.—Fence Rows.—Water-gaps and Flood-gates.—Farm Gates, 34-53

CHAPTER III.

FARM DRAINAGE.

Advantages of Draining.—How Draining Helps the Soil.—Prevents Failure of Crops.—When to Drain.—What Lands need Draining.—Tiles.—Materials for Drainage.—Open Ditches.—Depth and Distance apart of Drains.—The Outlet.—Laying out the Drains.—Silt Basins.—Digging the Ditch.—Cost of Drainage, . 54-72

CHAPTER IV.

MANURES.

How to get the most Manure.—How to Save it.—Pulverizing Manures.—Advantages of Manures.—Bommer's Method.—Special Fertilizers.—Commercial Manures.—Green Manuring: clover, rye, buckwheat, 73-92

CHAPTER V.

THE SOIL AND ITS IMPROVEMENT.

Origin of Soil.—Source of Nitrogen in Soils.—Purposes of Soil.—Varieties of Soil.—Sand.—Clay.—Humus.—Changing the Character of Soil.—What constitutes a Fertile Soil.—Drainage.—Cultivation.—Manures: Barn-yard, green, commercial.—Valuation of Fertilizers.—Food and Manure, 93-117

CHAPTER VI.

GRASSES AND CLOVER.

Grass Crop of the Country.—Varieties of Grasses.—Growing Grass.—Hay Making.—Shrinkage of Hay in Barn.—Millet.—Clover.—Time to sow Red Clover.—Clover for Pasture.—Fertilizers for Clover.—Growing Clover Seed.—Hoven, Clover Bloat, and Slobbers, Pages 118-139

CHAPTER VII.

CORN.

Average yield of Corn.—Reports from Corn-growers.—Seed Corn.—Soil adapted to the Crop.—Manures for Corn.—Preparing the Soil.—Corn-fodder and Fodder-corn.—Experimental Corn-plots.—Disposing of the Crop.—Corn-cribs, . . 140-165

CHAPTER VIII.

WHEAT.

Its Importance.—Soil.—Drainage.—Preparation of the Seed Bed.—Wheat on Corn Lands.—Fertilizers.—How and when to Sow.—Seeding, thick or thin.—Depth.—Varieties.—Harvesting.—Cost of Wheat-growing, 166-186

CHAPTER IX.

MISCELLANEOUS CROPS.

Oats.—Barley.—Rye.—Beans.—Broom-corn.—Harvesting.—Making Brooms.—Buckwheat.—Pumpkins.—Flax.—Cotton.—Sorghum.—Tobacco, 187-225

CHAPTER X.

ROOT CROPS.

Potatoes.—Planting and Tillage.—Harvesting, Storing, and Marketing.—Implementments.—Sweet Potatoes.—Cultivation.—Onions.—Turnips.—Beets and Mangold-Wurzels.—Carrots.—Artichokes, 226-252

CHAPTER XI.

FRUIT ON THE FARM.

Selection of Orchard Site.—Selection of Trees.—Plant young Trees.—Selection of Varieties.—Planting an Orchard.—Cultivation.—Apples.—Peaches.—Pears.—Dwarf Pears.—Plums.—Quinces.—Cherries.—Grapes.—Small Fruits: Strawberries, Raspberries, Blackberries, Currants, Gooseberries.—Commercial Fruit-growing, 253-281

CHAPTER XII.

GARDENING AND TRUCK FARMING.

What can be Grown on an Acre.—Selecting and Preparing the Garden Spot.—Laying out the Garden.—Implementments.—The Hot-bed.—When to Plant.—Insects.—Rotation and Succession of Crops.—Planting.—Disposing of Garden Crops.—Vegetables: Asparagus, Beans, Pole Beans, Beets, Cabbage, Carrots, Celery, Sweet Corn, Pop-corn, Cucumbers, Lettuce, Muskmelons, Watermelons, Onions and Potatoes, Parsnips, Peas, Peppers, Radishes, Rhubarb, Salsify, Spinach, Squashes, Tomatoes, Turnips, 282-315

CHAPTER XIII.

INSECTS INJURIOUS TO THE FARM, GARDEN, AND ORCHARD.

Colorado Potato Beetle.—Cut worms.—The May Beetle.—Wheat Midge.—Hessian Fly.—Wire Worm.—Pea Weevil.—Bean Weevil.—Squash Bug.—Squash Vine Root-borer.—Tomato Worm.—Cabbage Cut-worms.—Cabbage Leaf-roller.—Striped Flea-beetle.—Other Cabbage Moths.—Cabbage Fly.—Radish Fly.—Blister Beetle.—Striped Cucumber-beetle.—The Coddling Moth.—Old Apple-tree Borer.—Flat-headed Borer.—Apple-tree Bark-louse.—Twig Borers.—Canker Worm.—Tent Caterpillar.—The Fall Web-worm.—Plant Lice.—Plum Curculio.—Peach Borer.—Pear or Cherry-tree Slugs.—Plant Lice (Aphides).—Imported Currant Borer.—Imported Gooseberry Saw-fly.—Climbing Cut-worms.—The Rose Chafer.—Army Worm.—Cotton Worm.—Cotton Boll Worm.—Lice and Mites, Pages 316-365

CHAPTER XIV.

TIMBER GROWING FOR PROFIT.

Facts regarding timber.—Effects of Forests.—What Trees to Plant.—Where and How to Plant.—Locust Growing.—How to start a Locust Plantation, . 366-377

CHAPTER XV.

THE HOME AND ITS SURROUNDINGS.

Location of the House.—Size of House-lot.—The House.—Plans.—The Door-yard.—Shade-trees.—The Lawn.—Shrubs and Flowers.—Fences and Walks.—Out-buildings, 378-394

CHAPTER XVI.

SMALL FARMS FOR POOR MEN.

Small Capital.—Home Influences.—How to get a Home.—Building Associations.—How to Manage a Small Farm, 395-402

CHAPTER XVII.

HANDY THINGS ABOUT THE FARM.

Wagon-jacks.—Hog-jack.—Hanging-rack for Hogs.—Post-holder.—Log-holder.—Log-lifter.—Wood-holder.—Platform for Fence-building.—Hay-gatherer.—Husking Table.—Ladder for Loading Fodder.—Shocking-horse.—Hay Hook.—Crab for Shocking Corn.—Cheap Broom-corn Scraper.—Bag-holder.—Killing-post for Fowls.—Instruments for Preventing Self-sucking in Cattle.—Snow-plow.—Water-gap.—Stump-puller.—Wagon-bed Attachment.—Self-dumping Sled.—Potato Screen.—Roller Cover.—Feed Cooker.—Evener.—Land Measurer.—Tether Pin.—Beef Rack.—Shipping-box for Fowls.—Barrel Well-curb.—Ventilators for Stacks.—Bushel-box.—Gates.—Ladders.—Scare-crows.—Plant Protector.—Hogshead Sheep-rack.—Feed-boxes.—Tagging-table for Sheep.—Butting Preventor.—Shearing Table.—Hog Loader.—Home-made Root-cutter.—Kicking-curer.—Hanging Rat-proof Shelf.—Wheel Drying-rack.—Clothes-line Lifter.—Foot-scrapers.—Barrel Chairs.—Chair Step-ladder.—Chair Tool-box.—Slat Shelves.—Revolving Shelves.—Self-sucking Preventive.—Rack for Tomatoes.—Portable Shelter.—Garden Reel.—Water-gap.—Wire Stand.—Stacking Stage.—Rack and Manger.—Rain Gauge.—Land Measurer.—Barrel Coop.—Mink-trap.—Ringing a Hog.—Rat-trap.—Bag-holder.—Home-made Press.—Barn Closet.—Harness Clamp.—Corner Shelves.—Saw-buck for Long Wood.—Water-tight Box.—Hoof Hook.—Stable Barrow.—Barrel Sled, 403-436

PART II.

LIVE STOCK DEPARTMENT.

INTRODUCTION,	Page 439
-------------------------	----------

CHAPTER I.

THE HORSE—HISTORY.

The Fossil Horse.—Written History.—The Lesson of History.—The Hebrew Horse.—The Greek Horse.—Improvement of Horses came from Egypt.—Horse-races Instituted.—Endurance and Docility.—Olympian Races.—Southern European Horses.—Roman.—Arab.—Barb.—Degraded with Man.—Influence of Barb on Arab and English Horses.—Breeds of Arabian Horses.—The Thorough-bred.—Elements.—The Horse in Agriculture.—English Horses.—The Flanders Element.—Pedigree of Race-horse.—The Stud-book.—Climatic Influence.—Speed.—Draft-horses.—Norman.—French.—War Demands.—Percheron.—In America.—Canadian.—English Draft-horses.—Cleveland Bays.—The Farmer's Horse.—The Saddle-horse.—The Trotting Horse.—Various Trotters.—Ponies.—Shetland Ponies.—Mustang and Indian Ponies, 449-532

CHAPTER II.

THE HORSE—BREEDING.

Jacob a Color-specialist.—Bakewell, of England.—Heredity and Atavism.—Value of Pedigree.—Earliest Records.—High Breeding more than Appearance.—Breeding for Special Ends.—American and English Farmers.—Vices propagated.—Docility and Endurance Increased.—In-and-in Breeding.—General Principles of Breeding.—Cross Breeding.—Soundness of Parents.—Best age to Breed.—Color and size of Brood-mare.—Choosing the Stallion.—Farm Horses.—How size may be increased.—Influence of Sire and Dam.—Soundness, Quietness, and Temperament.—Condition at Breeding Time.—Working the Mare and Stallion.—French and American Methods.—Care of Breeding Mares.—Period of Gestation.—How to know Foaling Time.—Treatment of Mare at and after Foaling.—Care of Colts.—Abortion.—Sex: Can it be Controlled?—Importance of First Impregnation.—Valuable Hints, 533-593

CHAPTER III.

THE HORSE—BUYING AND SELLING.

Why Difficult—What is unsoundness?—Warranty.—Vices and Disabilities.—The Eyes.—The Feet.—The Limbs.—The Back and Body.—General Hints to Purchasers.—Points of the Horse, 594-610

CHAPTER IV.

THE HORSE—ANATOMY AND PHYSIOLOGY.

A System of Organisms.—Frame-work.—Muscular Development.—Physiology of Muscle.—The Blood.—Respiration.—Digestion.—Secretion and Excretion.—The Nervous System.—The Foot.—Mouth and Teeth.—Appearances of Teeth at different ages.—Diseases of Teeth, 611-634

CHAPTER V.

HYGIENE AND SANITARY CONDITIONS OF THE FARM.

The Air.—Ventilation.—Location of Barns and Stables.—Bank Barns.—Light and Pure Air.—Impure Air Poisonous.—Warm Stables.—Temperature of the Stable.—Size.—Ventilators.—Predisposing Causes of Disease.—The Stable Floor.—Care of the Feet.—Grooming.—The Stalls.—The Rack or Manger.—Disinfectants.—Labor and Fatigue.—Feeding, how and what.—Economy in Feeding.—Value of Bulky Food.—Corn-meal.—Accumulated Experience.—Drink.—Grooming for Health.—Condition Powders.—Hospital.—The Horse-blanket, Pages 635-672

CHAPTER VI.

THE ASS AND THE MULE.

The Ass.—His Antiquity.—Value.—Sire.—The Mule.—In America.—General Washington's Asses.—Breeding and Breaking Mules.—Experience in Breeding.—Managing.—Will-power and Stubbornness.—Longevity.—Winter Care.—The Hinny, 673-685

CHAPTER VII.

DISEASES OF HORSES.

Catarrhs.—Pneumonia.—Pleurisy.—Influenza.—Pink-eye.—Strangles, or Distemper.—Scratches, or Cracked Heels.—Mud Fever.—Grease-heel.—Eczema.—Surfeit.—Mange, etc.—Lymphangitis.—Elephantiasis.—Conjunctivitis (sore eyes).—Splints.—Spavin.—Collar-galls.—Saddle-galls.—Poll Evil.—Fistula of the Withers.—Sweeny.—Puffs.—Bog-spavin.—Blood Spavin.—Thorough-pin.—Curb.—Laminitis.—Navicular Disease.—Corns.—Punctures.—Bruises and Abscesses.—Lampas.—Wolf-teeth.—Indigestion.—Colic.—Worms.—Diarrhœa, or Scours.—Enteritis.—Azoturia.—Blistering.—Bots, 686-737

CHAPTER VIII.

CATTLE—HISTORY AND DESCRIPTION OF BREEDS.

Short-horns.—Their Origin.—Short-horns in America.—Characteristics.—The Herefords.—The Aberdeen-Angus, Galloway, or Polled Cattle.—The Holstein.—Devons.—In the United States.—The Ayrshires.—In the United States.—Channel Island Cattle: Jerseys, Alderneys, Guernseys.—Spanish, or Texan Cattle, . . 738-769

CHAPTER IX.

CATTLE—GENERAL MANAGEMENT.

Mistakes of Stock-men.—Raising Calves.—Fall Calves.—Plan of J. G. Ozer.—Pastures and Grazing.—Winter Care of Cattle.—Feeding for Beef.—Different Systems of Feeding.—The Labor-saving System.—Stall-feeding.—Feeding in general.—Grass and Grain combined.—Summer Feeding, 770-808

CHAPTER X.

CATTLE—SOILING AND ENSILAGE.

What is Soiling?—Saving of Land.—Saving of Fences.—Extermination of Weeds.—Saving of Food.—Of Manure.—Greater Production of Milk.—Objections to Soiling.—Who should Soil?—Soiling Crops.—Double-cropping in Soiling.—Silos and Ensilage.—How to make a Silo.—Filling the Silo.—Cost of Ensilage.—Crops for Ensilage.—Experiments, 809-832

CHAPTER XI.

CATTLE—THE DAIRY.

The Butter Product of the Country.—Selecting the Cows for a Dairy.—Testing.—Breeds.—Gilt-edged Butter.—Pastures and Food.—Full Feeding profitable.—Milking.—Milking Tubes.—How to manage the Milk.—Ice-houses.—Ice-chests.—Causes of Bad Flavor in Butter.—Skimming.—Churns and Churning.—Washing and Working.—Keeping Butter.—Brining Butter.—Family Cheese-making.—Curing.—The Factory System and its Variations.—Milk.—A good Cow.—Maintenance.—Handling Milk.—Modern Invention.—Lowering Temperature.—Deep or Shallow Setting.—The Centrifugal Cream-separator.—Its Superiority.—Results.—Associated Dairying.—The Stock Factory.—Private Factories.—Different Factory Systems.—At a Creamery.—A Full Stock Cheese.—The Curing Room.—Supply-houses.—The Exclusive Creamery.—The general Plan.—Co-operative Creameries.—A New System.—Creamery Butter.—Sweet and Sour Cream Butter.—Warnings.—Wastes of the Dairy, Pages 833-877

CHAPTER XII.

CATTLE HERDING.

Herding Cattle in Kansas.—Personal Experience.—Hard, long Winter.—Disasters.—Herding.—Selecting a Ranch.—Fire-guards.—The Best Breed.—Land Titles.—New Beginners.—Markets.—Brands.—Branding Chutes and Corrals.—Castration, 878-897

CHAPTER XIII.

DISEASES OF CATTLE.

Pulsation and Temperature. — Catarrh. — Anæmia. — Hollow-horn. — Broken Horns. — Bronchitis. — Choking. — Hoven. — Grain-sick. — Diarrhœa. — Scours (white).—Enteritis.—Parturition.—Abortion.—Inversion of the Uterus.—Parturient Apoplexy.—Paralysis.—Milk Fever.—Caked Bag, or Garget.—Texas Fever.—Mange.—Wounds.—Fractures.—Rheumatism.—Bathing. — Doses for Young Animals.—Condition Powders.—White Lotion.—Carbolic Lotion.—Black-leg, . . 899-930

CHAPTER XIV.

SWINE AND THEIR MANAGEMENT.

Hogs on the Range.—Of no particular Breed.—Hogs in the United States.—Who should raise Hogs?—Improvement of Stock.—Selection of Breeding Stock.—Management of Swine.—Litters.—Diseases of Swine.—Causes of Disease.—Preventive Measures, 931-947

CHAPTER XV.

SWINE—DESCRIPTION OF BREEDS.

The Poland-Chinas.—The Berkshires.—The Chester Whites.—The Essex.—Jersey Reds.—The Suffolks.—The Yorkshire.—The Cheshire.—Lancashires.—Victorias, 948-965

CHAPTER XVI.

SWINE—HOUSING AND FATTENING.

Hog-houses and Pens.—Plans of Hog-houses.—Portable Pig-pens.—Swill-barrels and Troughs.—Shall we cook Food for Hogs?—Green Food for Hogs.—Winter care of Hogs.—Fattening.—How much Pork from a Bushel of Corn.—The Hog as a Manure-maker, Pages 966-991

CHAPTER XVII.

SHEEP.

The Spanish Breed, or Merino.—Mutton.—On the Atlantic Slope.—The Submontane District.—The Prairie Section.—The Far West.—Australia.—South America.—Mexico.—The Cotswold Sheep.—The Leicester.—South-Down.—In-and-in Breeding.—Lambs.—Time for.—Feeding.—Tagging.—Lambing.—Lambs with the Flock.—Winter care of Lambs.—Fattening.—Wool.—Housing Sheep.—Washing.—Shearing.—Wool-press.—Time for Shearing.—Drafting and Marking.—Ticks.—Mag-gots.—Water for Sheep.—Salt.—The Fly.—Paper Skin.—Scald-foot, or Fouls.—Scab.—Sheep Barns.—Plan of Sheep-houses and Yards.—Mangers.—Sheep-hook, or Shepherd's Crook.—Sheep as Scavengers of Foul Lands.—Dogs, 992-1039

CHAPTER XVIII.

POULTRY.

Is Poultry-keeping Profitable?—Poultry on the Farm.—Poultry-keeping for Women.—Poultry-keeping for Boys and Girls.—Number of Fowls that may be kept profitably.—Capital required.—Location.—Poultry-houses.—Plans and Descriptions.—Inside Fixtures.—Yards and Fences.—Best Breeds for Special Purposes.—Hamburgs, Leghorns, Houdans, Black Spanish, Polish, Bramahs, Cochins, Plymouth Rocks, Dominiques, Wyandottes, Dorkings.—Improve the common Fowl.—Choice of a Cock.—Eggs.—Market Poultry.—Management of Laying Hens.—Food and Drink.—Best Market in Prices for Eggs.—Shipping Eggs.—Preserving Eggs.—Spring Chickens.—Eggs for Hatching.—Nests and Sitting Hens.—Egg Testers.—Artificial Incubation.—Care of Young Chicks.—How to raise Incubator Chicks.—Coops and Runs for Young Chicks.—Feeding Pens.—When, where, and how to market Spring Chickens.—Fall and Winter Chickens.—Capon.—Turkeys:—Bronze Turkeys.—White Holland.—Setting the Eggs.—Feeding the Young Turkeys.—Taking care of the Brood.—Fattening Turkeys.—Ducks:—Pekins, Rouens, and Aylesburys.—Cayugas.—Muscovies.—Treatment of Ducks.—Food.—Picking.—Geese:—Toulouse, Embden, China.—Time of Laying.—Hatching.—Feeding and Fattening.—Preparing Poultry for Market.—Laws of New York and New England.—Shipping Poultry and Wild Fowls.—Packing, 1040-1118

CHAPTER XIX.

POULTRY: DISEASES AND THEIR REMEDIES.

Causes.—Prevention.—The Douglass Mixture.—Care.—Lice.—Lice on Chicks.—Chicken Cholera.—Roup.—Gapes.—Chills.—Cramps.—Scaly Legs.—Leg Weakness.—Rheumatism.—Canker.—Bumble-foot.—Diarrhœa.—Frost-bites.—Crop-bound.—Egg-bound.—Eggs broken in Oviduct.—Apoplexy.—Soft-shelled Eggs.—Egg-eating.—Feather-eating.—Moulting.—Obscure Diseases of Chicks, . . . 1119-1132

CHAPTER XX.

BEES AND BEE CULTURE.

Agricultural Journals.—Hindrances to the Culture of Bees.—Requisites to Success.—Natural History of Bees.—The Queen.—Drones.—Worker Bee.—Races of Bees.—Products.—Practical Bee-keeping:—Hives, Frames, and Crates.—Location of Apiary.—Transferring Bees.—Feeding.—Queen Rearing.—Clipping the Queen's Wings.—Fertile Workers.—Uniting Colonies.—Increasing the Number of Colonies.—Hiving.—To prevent Swarming.—How to Italianize.—To Introduce a Queen.—Shipping Queens.—The Good Candy.—Shipping Bees.—Extracting Honey, and the Extractor.—Handling Bees.—Comb Foundation.—Save the Wax.—Marketing Honey.—Honey Plants.—Wintering Bees.—Spring Dwindling.—Diseases of Bees.—Enemies of Bees, Pages 1133-1170

CHAPTER XXI.

THE CHEMISTRY OF FOODS AND FEEDING

Composition of the Animal Body.—Foods.—Use of Food.—Use of Different Food Constituents.—Different Foods.—Digestibility of Foods.—Albuminoid Ratio.—Influence of Water in Foods.—Feeding.—Reducing the Food of Support.—Increasing the Amount of Food Supplied.—Proper Adjustment of Food.—Ratio for Young Animals.—Ratio for Milk.—Fattening Animals.—Feeding as influenced by Age.—Profitable Feeding, 1171-1192

CHAPTER XXII.

THE BARN AND BARN-YARD.

Careful Thought and Planning necessary.—Plan for a Tasty and Convenient Barn.—A Bank Barn.—Cheap Barn and Barracks.—Lumber Required.—Cost.—Approaches.—Sheds and Racks.—Rack for Stacking.—The Barn-yard.—Manure Ditch.—Cow-stable.—Slatted Floor.—Stanchions, 1193-1202

CHAPTER XXIII.

AGRICULTURAL APHORISMS, 1203-1211

Appendix.—Principal Cereals in the U. S.—Number of Live-stock in the United States.—Total Cotton Production, and average Product per acre.—Highest and Lowest price of Cotton for 42 years.—Tobacco Production in all the States.—Statement of the Tobacco Crop of the United States.—Census of the United States.—Acreage and Value of Crops of Principal Cereals in the United States.—Average Cash Value of Farm Crops.—Sugar Product of Louisiana for 48 years.—Area of the States and Territories of the United States.—Relative Number of Plants or Hills to an Acre.—Area occupied by the Principal Crops of the United States.—Duration of Animal Life.—Weight of a Bushel of Produce.—Interest Laws of the United States.—Compound Interest Table.—Classification of Soils.—Comparison of Measures of Capacity.—Measures of an Acre Plot.—Square Feet and Feet Square in Fractions of an Acre.—To Measure Cisterns and Casks.—To Measure Land.—Measurement of Hay.—To Measure Corn.—Measurement of Wood and Lumber.—Quantity of Seed or Plants required per Acre, 1213-1225

INDEX, 1227-1244

INTRODUCTION.

BY HON. NORMAN J. COLMAN,

ST. LOUIS, MO.

The sceptered king who sits in state,
Or hero in red battle's shock,
Is not so worthy, not so great
As he who plows and keeps the flock.

THE first man was a farmer, or at least a gardener. The *Adam* was an earth-man—for such is the meaning of the word. If we may trust the legend of Genesis he began his career in an orchard. The first awakening of his consciousness and the first pleasurable excitement of his senses were under the fruit-bearing trees, planted by those ancient rivers of water. The first toil to which his bodily powers were given related to the earth and its natural products. The hunter, with his bloody vocation, came afterwards; and then the merchant with his ships. It must ever remain an interesting fact that in the ages most remote of human history, in an epoch long before the Greek and Latin civilizations were planted in Southern Europe, even before the hymns of the Vedas had been chanted in the valley of the Indus, far back in the old Aryan homestead of primitive mankind, the pursuits of our fathers were those of the field, the orchard, and the garden. The smell of the new-broken soil, grateful and intoxicating as the sea breezes of the Canaries, filled the nostrils of that undiseased race of men whose descendants have civilized the world. Agriculture, and not the chase or war, was the earliest, as well as the noblest, vocation of those ancient tribes from which the great races have derived their strength and renown. The word *plow* is the same in all the powerful languages sprung from the ancient and venerable fountain of Aryan speech; and the word *art* is derived from the old root *ar*, signifying “to stir the soil.”

Many other pleasing trains of thought arise in the mind of him who reflects on the dignity and poetry of that great fundamental calling from which all other callings are but derivatives. Agriculture is a pursuit well calculated to cool and subdue the emotions and passions of men long heated in the struggling marts of commerce and the red furnaces of war.

It seems that some such pursuit has been necessary in the economy of civilization to check the ferocity of unscrupulous progress and to prevent the excited juices of development from bursting the rind of nature. In the quiet of the fields man finds rest. His exhausted powers revive as he directs with the hand of intelligence the beneficent forces of the natural world. In such a vocation he finds a safe refuge from the clamor and jealousy of his fellow-men, and a hiding-place from the haunting shadow of himself.

It can not be denied that the avocations of the agricultural life are, *per se*, the most pleasant which men have ever followed. Such a calling brings into healthful exercise both mind and body. It neither racks the one nor wrecks the other. Even to old age something of the freshness of youth survives in him whose powers have been devoted to the affectionate care of mother earth and the protection and increase of the flocks. To such a man the aching bones, the stiffened joints, the distorted form, and the hungry soul are still indefinitely postponed. The author of the twelfth chapter of Ecclesiastes did not select his famous type of decrepitude from a farm-house. The aged father is likely to be a philanthropist. Under the influence and reactions of his vocation he hides his face in the bosom of nature and learns to love the order of the world; he trusts causation, and believes in law.

In our age, overheated, as it is, with excitement and frenzied with speculation, it is delightful to turn from the conscienceless schemes of trade and the mad struggle for riches to the green fields and pasture lands, and to see once more the *country home* rising over the garden croft and blossoming orchard. In the presence of such a scene the old-time virtues revive, and the mind of man, reacting from its passions, enters into quick and generous communion with the temperate spirit of nature.

It is simply a truism that, in a generation like ours, running into every excess by the cultivation of secondary and the neglect of primary industries, we should hail with delight every agency and circumstance which is calculated to check the evil tendency of the epoch. If a great man appears—great by force of original genius and great by his adherence to those fundamental callings upon which the real progress of the world depends—we should greet him with hearty acclaim and cordial sympathy. Especially when a valuable *book*—one well fitted by its expositions and sound spirit to encourage the virtues of industrial life and to discourage its vices—is offered to the public, we should give to such a work a hearty greeting and cordial indorsement before the people.

It has been the misfortune of the agricultural life that its literature has not, as a rule, been worthy of the theme. For some reason, not easy to discover, the works on agriculture and the raising of stock have been pitched in so low a key, and executed with so little regard to taste and refinement, that the reader has been injured rather than improved, misled rather than taught, by the work which he has perused. For this reason it is a great relief to turn to a really meritorious and comprehensive treatise on the interests peculiar to the farming life. Without intending to indulge in invidious comparisons it is safe and proper to say that the one great work of our day, conforming to the high standard here indicated, is "The People's Farm and Stock Cyclopedia," by the distinguished Waldo F. Brown, of Ohio. Certain it is, that wherever there is a discerning public, this work is destined to a hearty and universal appreciation. The author has produced, indeed, the only standard book which has yet appeared on those most important topics, the management of the farm and the rearing of stock.

Time would fail, in this brief introduction, to summarize all or even the larger part of the merits which may be justly claimed for "The People's Farm and Stock Cyclopedia." The author and the publishers alike may well be complimented for the successful accomplishment of a work which can but place the whole farming world under lasting obligations of gratitude.

It is the first peculiarity of the work in question that it is what the name implies, a true, universal dictionary of knowledge as it relates to all subjects covered by the title. Though prepared under the chief editorial direction of Waldo F. Brown, it contains the best efforts of no fewer than *ten* additional contributors, every one of whom is a specialist in that department of the work which he has prepared. The true plan has been followed, so that the public may now obtain in this single volume the very best results of the study and observation of men who have been placed in such relations as to make their views a finality on nearly every topic referred to in the volume.

The present work is the perfected result of the study and devotion of one who has been a farmer all his life. It is well known that many books on agriculture and stock raising have been written and foisted upon the public by men who have gathered their meager and imperfect information at *second hand*, and whose views on the practical work of farming have been, for this reason, *utterly worthless*. Such authors are the quacks and charlatans of agriculture, and their works are to be classified with pernicious pamphlets and flashy advertisements

of patent nostrums. Waldo F. Brown, the author of "The People's Farm and Stock Cyclopedia," has been a farmer for more than forty years, and his great work is the matured fruit of observation and experience extending to every topic relative to the care of the home, the garden, the orchard, and the field. He writes of what he knows, and his counsels are those of an old and tried friend giving advice to the tyro of the farm. He takes the hand of the inexperienced, and says to him, "This is the way to success." The same is true of all those who have assisted the author in the preparation of the work. Every one of them has added to his theoretical knowledge the higher wisdom of experience.

He who peruses the following pages will be strikingly impressed with the comprehensiveness of the work. In respect to its scope, the variety of subjects treated, and the care with which the topics are discussed, the book is without a rival. Many agricultural works have been published so partial and incomplete in character as to be practically valueless. It has remained for the author of "The People's Farm and Stock Cyclopedia" to traverse all the fields of interest and to elucidate every *difficult question* relative to the successful management and improvement of the farm. He has not left unnoticed any single practical point relating to *the success of the farmer*. The beginner in agriculture may be sure of finding in this one volume every topic discussed to which his attention will be practically called in a whole lifetime on the farm.

Another prominent feature of "The People's Farm and Stock Cyclopedia" is the great prominence given in the work to the matter of breeding and raising stock. In this respect the treatise is exhaustive. All kinds of domestic animals, from cattle and horses to poultry and bees, have received a faithful consideration at the hands of the authors. It is well known that many works on farming have stopped short with the discussion of a few of the more obvious and easy topics of agriculture while the more difficult and important matter of the breeding and rearing of animals has been neglected. This defect in previous publications has been completely remedied in "The People's Farm and Stock Cyclopedia." Every question of information and management of interest to the live stock grower has been handled in a way so masterly and admirable as to make the present work *incomparably superior to any of its predecessors*.

It is, however, in the treatment of specialties that the following pages will be found of pre-eminent value. This great merit has been secured in the work by extending the list of contributors so as to

include the very best talent of the country. In the preparation of this Cyclopedia the editor-in-chief has been assisted by the following brilliant corps of special contributors: L. N. Bonham, agricultural editor of the Cincinnati *Commercial*; R. S. Thompson, author of "Science in Farming;" R. W. Stewart, D. V. S., the popular veterinary surgeon; Henry Talcott, president of the Ashtabula County (Ohio) Sorghum Association; John G. Oser, the successful cattle breeder; A. J. Cook, professor in the Michigan State Agricultural College; "Fanny Field," the practical and successful poultry raiser and writer; John Gould, agricultural editor of the Cleveland *Herald*; Edwin W. Brown, practical cattle breeder and experienced herder; Stephen Powers, author of "Sheep Experience Papers;" John M. Stahl, the noted agricultural writer and author of "Agricultural Aphorisms," etc. These names are of themselves a sufficient guarantee of the value and originality of the chapters which they have respectively contributed. It would seem that they have omitted no subject of importance. Of the thousand interests which spring up on the farm, and which present themselves with peculiar attractiveness to specialists, not one has been neglected. Take, for instance, the poultry raiser. To him "The People's Farm and Stock Cyclopedia" is what a dictionary is to an author. "Fanny Field" is, perhaps, the best authority on the breeding and rearing of poultry in America, and her practical success has, for years, attested her preëminence in her special work. So, also, in the matter of raising bees, Professor Cook has long been regarded as the pioneer philosopher of the apiary. His views are held in the highest esteem by every bee culturist in the country. Mr. L. N. Bonham and Dr. Stewart, to whose able pens the public is already greatly indebted, have given in the chapters on the breeding and treatment of the horse all that science and experience have contributed to the care and improvement of that noble animal. In the department of agricultural chemistry—a science hitherto but little understood—Mr. R. S. Thompson has given the results of the latest research, and made plain to every intelligent reader much which has been to him a mystery, but which he needs to understand to enable him to farm intelligently and profitably. So, in every other chapter of the work devoted to the special interests of the farm, the Cyclopedia is infinitely superior to all rival publications.

Still another feature of the following pages will be found to merit the highest praise. This is the literary style of the work. The general character of the Cyclopedia is such as to add dignity to the subject and improve the tastes of those who read it. In this respect the work *stands alone*. Nearly all the books hitherto given to the public

on the subject of our great farming industries have been conceived and executed in so slovenly and inelegant style as to offend true taste, and to give to farmers' sons and daughters a dislike for the pursuits of their fathers. It has been the constant aim of the authors and publishers of "The People's Farm and Stock Cyclopedia" to rise from this low level, and to present to the farming public of America one book which does honor to the most noble of all the professions. It is confidently believed that discerning readers, everywhere, will be impressed with the great literary superiority of "The People's Farm and Stock Cyclopedia" to all other works of the kind. The book, as a book, is so elegant and tasteful that it will occupy a place on the parlor table of the wealthy farmer as well as on the humble shelf of his less prosperous neighbor.

Any review of "The People's Farm and Stock Cyclopedia" would be inadequate which failed to note the healthy moral tone of the book. This is a quality which has been altogether too much neglected by the purchasers of matter for the library. No one can afford, in making selection of a book, to pass over that which may be appropriately called the *spirit* of the work. "The People's Farm and Stock Cyclopedia" will be found as invigorating in its tone as it is accurate in statement, elegant in style, and superb in illustrations. It is emphatically an honest book. True enough it teaches how to get rich, but does not teach dishonesty and fraud. Whoever would see in his children the realization of the Scriptural ideal, "That our sons may be as plants grown up in their youth; that our daughters may be as corner-stones polished after the similitude of a palace," must surround them with healthful books, so that the principles which they absorb may be sound and virtuous. Such a work is here presented and dedicated to the farmers of America.

N. J. C.

ST. LOUIS, MO.,

January 1st, 1885.

THE PEOPLE'S FARM AND STOCK CYCLOPEDIA.

PART I.—THE FARM.

CHAPTER I.

GENERAL FARM MANAGEMENT.

WE often see two farmers living side by side, whose land is very similar, and who began life with equal chances, one of whom is surrounded with comforts and evidences of thrift, and who loves his calling, while the other is surrounded with evidences of failure, and is constantly complaining of the hardness of a farmer's lot. It is not always the case that the successful farmer is the more intelligent man, for often men of good minds, industrious habits, and more than average intelligence fail as farmers; and the difference between the two, a difference which often involves the happiness of a life-time, consists not in intelligence, but management.

Want of success in farming is often due to the fact that the farmer does not appreciate the dignity of his calling. He looks upon farming as a simple art, requiring but little education or thought, and dependent more upon muscle than brain, and therefore fails to study it and wisely plan for the future. While Divine Providence has wisely ordered that the cultivation of the soil shall be a simple art, so that even the uneducated and ignorant may gain thereby a living, it is also true that it is a profound science, sufficient to call into use the best mental powers of the wisest man. The young farmer who understands

this will stand a better chance of success than he who looks upon it as an occupation but one step above that of a day-laborer.

In many instances the first thing calling for the exercise of thought and judgment is

The Selection of the Farm.—One should not be too hasty in deciding a question of so great importance as this, for it is far better in a majority of cases that the young farmer should make a permanent selection. It is one of the evils of farm life in America that so many of our farmers are ready to sell out at the first good offer, and that so few have lived on their farms long enough to become attached to them. If, then, the farmer is locating for life, it becomes a matter of serious importance that he should study carefully every detail, and act understandingly in the matter. Let us look at some of the considerations which should influence his decision in this important matter. First the farm must be suited to his means. Many farmers, to-day, are tired of their calling, discouraged in their efforts to improve, and failing to farm at a profit, from the fact that they are in debt. It is the bane of farm life. I do not, by any means, say that the farmer should never incur debt in buying a farm, for the majority of young farmers must do this, but it should be only after the most careful thought and study. It is often wiser to buy a smaller farm than to run deeply in debt for a larger one. The question of the size of the farm should be determined by the means of the farmer, the particular branch of farming he intends to follow, and his business capacity. Both large and small farms have their advantages. On a large farm it will pay to invest in more labor-saving machinery, and this can be kept more fully employed. More help can be kept permanently, and this will enable the farmer to concentrate the labor on some particular work in an emergency. On a large farm there is a better opportunity for rotation of crops and diversified farming, and more stock can be kept, which will, under good management, not only keep the farm more fertile, but also give an equal income with less labor than where most of the soil must be cultivated. On

a large farm the proportion of fencing to the number of acres may be greatly reduced, and thus one heavy item of investment and expense be materially lessened. It must be remembered, however, that to conduct successfully a large farm, requires executive ability and business habits, and that many men can successfully carry on a small farm who would fail on a large one.

On the other hand, there are many advantages connected with small farms. They are usually cultivated by their owners, and this gives a more densely settled neighborhood and better improvements. The man on the small farm can largely dispense with hired help, and save his wife the extra labor which their board and lodging brings upon her, often when she is already overburdened with the care of little children. The man on the small farm can usually control his expenses so that a failure of crops will not be so disastrous to him as to the man with a large farm. As a rule, small farms are more thoroughly cultivated, and produce more, in proportion to their size, than larger ones, and this means larger yields per acre and less cost per bushel.

Adaptation of Farm to Individual is another important consideration. Tastes differ in farming as well as in other matters, and while one man prefers to make a specialty of sheep, another will prefer cattle or hogs. One man delights in "high farming," and will succeed best as a "truck farmer," cultivating a few acres with a large amount of labor and manure, while another has no taste for this method, but wants to follow the regular order of large breadths of staple crops. Now, each man will succeed best in that which he likes best, and should consult his taste in purchasing a farm. If he wishes to make a specialty of sheep, a high, rolling farm will be best for him. If hogs, he will require rich bottom lands or loamy upland. If he wishes to follow truck farming, he must locate near a village or city where labor is abundant and he can obtain manure and find a market for his products, and he must have warm, sheltered land, or he can not get his vegetables into market early and realize the best prices. Thousands of farmers have worked at a disadvantage all their lives simply because they did not consider this

matter of personal taste and adaptation of farm to the particular line of farming they wished to follow, and therefore located unwisely. Still another point which should receive careful consideration in selecting a farm is the

Condition of Soil and Improvements.—Shall he purchase a run-down farm and improve it, or one highly fertile and with buildings, fences, etc., in good repair? Here is a matter requiring the exercise of good judgment and thorough investigation. My own experience teaches that a poor, run-down farm may often be bought so low that it will pay to make the necessary improvement in soil and buildings.

If the farm offered has the reputation of being unproductive, examine carefully the causes. If the land is rolling and its want of productiveness comes from the soil having been washed away, or if the soil is thin and leachy, do not for a moment think of settling down for life upon it. If, on the other hand, you find a naturally strong, retentive soil, especially a clay on limestone foundation, which has been exhausted by cropping without rotation or manuring, or if the farm is cold and unproductive from the want of drainage, and there is sufficient fall to thoroughly drain it, the question becomes simply one of price, and a farm of this kind can often be bought so cheaply that it will prove a profitable investment. The same is true of improvements, and while, as a rule, it will cost more to put up new buildings than to buy them, it is not always so, and new buildings will cost nothing for repairs for many years, and may be planned and arranged to suit your taste. To take an unproductive farm with buildings dilapidated and make it productive and sightly, is a work which pays in the pleasure it affords, and which should entitle one to the gratitude of the community.

As health of body is essential to comfort in life and to the discharge of our duty, the matter of the healthfulness of the locality should be carefully looked into. Fertility of soil is desirable, but there are many localities where the very richness of the soil gives proof of malaria, and to settle on these lands is to invite fever and to endanger the life of your loved ones. Even in healthy localities there are often local causes of dis-

ease, and the situation of the buildings or the location of wells, drains, or barnyard may be such as to cause contamination of the air or water, and bring disease.

The Water Supply.—On every farm there should be an unfailing supply of pure water, convenient to house and barn. I would not purchase a farm that was deficient in this respect. In some of the finest farming lands with which I am acquainted there is nearly every year a surplus and a famine of water. In the Winter and early Spring the wells are flooded, and the water stands at the surface, while in the drought of Summer they fail entirely, and the supply for both man and beast is precarious and unwholesome. In some localities this defect can be remedied by constructing cisterns, but where the supply is deficient and there are serious natural obstacles in the way of overcoming this difficulty, it will be well to think twice before locating.

Roads and Convenience to Market should receive careful consideration. The farmer who must wagon his crop for many miles over mud roads to reach a market, and who is often mud-bound for months in an open Winter, is living at a decided disadvantage. The cost of marketing grain from a farm on a good turnpike within two or three miles of a railroad station is seldom more than one or two cents a bushel, but if ten miles of hilly and muddy roads intervene between the farm and the market, this cost will be doubled or even quadrupled. Convenience to post-office, store, blacksmith shop, schools, and churches will add largely to the value of the farm and the comfort of the farmer and his family.

In going to a new locality, one can not be too careful in his inquiries as to the character of the community. There are neighborhoods entirely destitute of public spirit. The citizens are content to drag through the mud rather than to make good roads, although plenty of material lies near at hand. They allow their stock to roam at large and trespass upon their neighbors, and would quarrel with any one who would try to enforce the law against it. Again there are neighborhoods where there is a spirit of infidelity or immorality prevailing, where the Sabbath is disregarded and profanity openly indulged in. The wise par-

ent will find out the spirit of a community before taking his family to live in it, as no pecuniary gain can compensate for moral loss. "Lot pitched his tent toward Sodom," attracted by a rich soil, but the wickedness of the inhabitants involved him in ruin.

Choice of Farm Products.—The farm being selected, the next question to settle is what particular line of farming shall be followed, and as it is important to start right, you should give this matter careful study. Two adjoining farms often call for an entirely different system. For example, along the water-courses there are usually wide bottoms, and here we have one or more tiers of farms which are admirably adapted to hogs. The soil is warm and rich, and will bear almost continuous cropping in corn, and often it is so situated that the rains, which would greatly damage rolling lands, bring rich sediment on to these fields and increase their fertility. On these farms a rotation which includes clover once in four years will keep the land at a maximum fertility. A short distance further back from the stream will be found a row of farms located on the hill side. The land often slopes quite rapidly, and is broken by ravines. To follow a system of corn cropping on these farms is ruinous, as it soon results in the washing away of the soil, and reduces the farms to sterility. The only system on these farms that will pay in the long run is to make grass a principal crop. These broken farms are often the best fruit lands in the vicinity, and the farmers in the bottoms can better afford to buy their fruit from their hill-side neighbors than to grow it on their richer lands.

It is not at all certain, because your neighbor whose farm joins your own has found a certain crop profitable, that you will do so, for the conditions of the soil or the capacity of the individual may vary so as to make a system that is profitable on one farm unprofitable on an adjoining one. It would seem as though the above fact was so obvious that it would be unnecessary to even allude to it, but observation will soon show that many farmers fail in this particular. Side-hill farms are cropped and cultivated until they will not even produce grass; orchards

are planted on low, rich land, where they are almost sure to be winter-killed, and farmers are continually changing and shifting their plans and varying their products, in hopes of increasing their profits, without any definite plan or purpose in view.

It is of the utmost importance that the farmer take into consideration all the circumstances connected with his farm and its surroundings, soil, climate, market, location, and roads, and then fix upon a settled plan and adhere to it. Do not forget that the farmer who has any product to sell every year is sure to hit the high prices as well as the low, while the one who is continually changing is usually tempted to do so when some product is high, and oftener than otherwise by the time he has a crop ready for market the reaction has come, and prices are at the bottom. I feel that this is a matter of such importance as to justify my saying a good deal about it, for there is a constant temptation to the farmer to change his plans, and unless he has wisely studied the matter and determined what crops he will grow he is liable to blunder. I have often seen farmers when sheep and wool commanded the highest prices sell off their other stock and buy sheep at twice their real value, and by the time they were able to realize from them the price was below the cost of production. Occasionally there comes a season when broom corn brush brings from two hundred dollars to three hundred dollars a ton, and it is almost universally the case that so many farmers will plant it the following year as to bring the price down to a point that will leave no profit. I have known it to sell at forty dollars per ton. I do not mean to teach that a farmer should never change his plans or products, but he should do so cautiously and intelligently, after mature deliberation, and should always be able to give a satisfactory reason for the change. I think that in a great majority of cases the change is made in the same spirit that a lottery ticket is bought.

An important consideration in determining what shall be the leading product of the farm is the cost of marketing. If, as is often the case, a farmer living from six to ten miles from market on bad roads depends on the sale of corn, the cost of delivering it will be from five to eight cents a bushel, and if he sells at

forty cents per bushel, this will be from twelve to twenty per cent of what he receives, while wheat at one dollar per bushel could be delivered at from four to seven per cent, or a drove of cattle or hogs could be delivered at the same market for a very small fraction of one per cent of their value.

The effect on the fertility of the soil of the system adopted must be carefully considered. Too much of our farming is illustrated by "killing the goose that laid the golden egg." The American system of farming has been a prodigal one, for it is not long since the day when it cost less to destroy a forest and thus get a new and fertile field than to enrich an old one; but in most of the States the limit has been reached in this direction, and now the farmer must not only maintain but increase the fertility of his soil. The farm is his capital, and any system which reduces its fertility is wasteful and improvident. One of the greatest aids in maintaining fertility is

Rotation of Crops.—The fact is well known to all practical farmers that the continual growing of any particular crop on a field will gradually reduce its productiveness until the point is reached at which it can no longer be profitably cultivated. This period may be longer or shorter, according to the nature of the soil or the character of the crop, but the result will be inevitable. Another fact, equally familiar to the farmer, is that a field partially exhausted by one crop will produce some other. Another fact, not so easily understood, is that after the second crop has been grown for some years the soil will be found to have regained to a greater or less extent the capacity of producing the first.

Practically a good system of rotation enables the farmer to grow, at little or no expense, his fertilizers in the soil where they are needed. It also more than doubles the value of the manure applied if used intelligently and judiciously. But as these questions will be more fully discussed in the chapter on manures I will pass them for the present.

How Much to Cultivate is an important question to settle in your plan of farm management. In large sections the greatest evil is over-cropping. I am familiar, and have been for nearly

forty years, with many farms two-thirds of which are kept under the plow. Some of these farms have not during that time produced an average of ten bushels of wheat or thirty of corn to the acre, and yet the owners keep on in the old ruts, producing crops which five minutes' calculation would show them do not pay the expense of cultivation, and apparently deluding themselves with the idea that they are doing something because they are going over so much land each year. Their management recalls the anecdote of the German clothier who solemnly assured his customer that he was selling his goods at less than cash cost, and on being asked how he made a living, answered: "Pecos I sells so many."

There are a few facts connected with this question of the amount of land to plow that should be understood by every farmer :

First—All the profit in farming comes from maximum crops. From the statistics, as shown by the census reports of the United States, it appears that the average yield of the corn crop is about thirty bushels per acre, and that the average yield of the wheat crop is about fourteen bushels per acre. That these averages will give no profit is evident to every experienced farmer, and as these are the averages, there must be many who grow less, for we know there are many who grow much more to the acre. We might, then, divide farmers into three classes—those who are growing crops above the average and make money, those who grow average crops and make a living, and those who grow crops below the average and barely keep soul and body together.

Second—The man who cultivates a smaller part of his land can do it more thoroughly, and can have it richer. It is often of the greatest importance to a crop that the cultivation should be at a certain stage of growth or condition of soil; for example, on our heavy clay lands a heavy rain forms a crust, which should be broken as soon as possible after the land is dry enough to work. The farmer who undertakes to cultivate forty acres with one team is obliged to neglect this at this critical time; and his crop is often permanently injured. If, as I believe, the adage

"tillage is manure" is true, the farmer is wise who so arranges his crops that the tillage can be most thorough. I say that he who tills less land can have it richer. This is plain for two reasons—with more land in grass he can keep more stock and save more manure, and he can also grow sod to turn under, which is the best and cheapest manure in the world, and produces the best mechanical effect on the soil.

Third—The cost of grain per bushel is decreased in the exact ratio that the yield per acre is increased. Suppose we take twelve dollars as the average cost of producing an acre of wheat or corn, this sum to cover rent of land, preparation of soil, planting, cultivating, and harvesting. A crop of wheat averaging twelve bushels per acre will cost one dollar per bushel. Twenty bushels will bring the cost down to sixty cents per bushel, and thirty bushels per acre will cost but forty cents per bushel. Thirty bushels of corn to the acre will cost forty cents per bushel; forty bushels per acre will cost thirty cents per bushel, and sixty bushels will cost but twenty cents per bushel. You may think my estimate of twelve dollars per acre incorrect, but take any other amount you please, and it will not change the principle. Now, the surest way on many farms to double the yield per acre, and so reduce the cost per bushel, would be to reduce the acres under cultivation one-half. The land not in grain would be producing grass or clover, and the soil filling with roots to decay and furnish humus to the plants to follow after.

This matter of decreasing the acres under cultivation and increasing the yield per acre, and at the same time keeping down expenses, is so important that I wish to present it in still another light. Let us suppose two farmers starting in life on adjoining farms of equal quality, each of which has eighty acres of tillable land. One of them, possessed with the prevailing idea that he must cultivate a large breadth, begins with two teams, and plows from fifty to sixty acres each year. Let us make an estimate of the additional expense that this extra team will involve during a term of ten years. We will call the team and harness three hundred dollars to start with, and as the team

must have a driver it will necessitate keeping a hired hand for say eight months of the year, and at fifteen dollars a month this would be one hundred and twenty dollars per annum, or twelve hundred dollars for the ten years. Then, both horses and hand must be fed, and counting that it costs one dollar a week to keep a horse, the bill for the team will be one hundred and four dollars a year, or one thousand and forty dollars more. The board of the hand at the moderate rate of two dollars per week would make seventy dollars a year additional, and this gives us seven hundred dollars. We will offset what the old horses and harness would be worth at the end of the ten years against extra plows, horseshoeing, and repairs to farm implements, and as the teams would be pretty well worn out this seems to me to be a liberal price for them. Now we will bring these items together, and see what they foot up.

First cost of team and harness,	\$300 00
Keep of team for ten years,	1,040 00
Hired man, eight months a year for ten years,	1,200 00
Board of hired man,	700 00
Total,	<hr/> \$3,240 00

The above sum can, I think, be fairly charged as the expense involved by keeping the extra team, and the question to be decided is, Has this expenditure brought a corresponding increase of income? I think it safe to say in nine cases out of ten it has not. The fact of having the two teams and keeping the extra hired man has been a continual temptation to plow too much land, and the consequence has been exhaustion of the soil, decreased yield per acre, and more frequent failure of crops.

Now, let us look at the management of the other farmer, who has learned that bushels, not acres, is the thing to be sought. He starts with a single team, and plows from thirty to forty acres a year. This enables him to practice a rotation, so that he has a breadth of clover sod to plow each year. He can also keep more stock and save more barnyard manure. While his neighbor's farm is necessarily growing less productive his is increasing its yield. His wheat, on a rich soil, resists frost, fly, and chinch-bug, and makes a crop when his neighbor's fails, and

before the ten years expires he is producing more grain than his neighbor, who is cultivating double the acres. He has had less labor, worry, and risk, his wife has had less care, and his farm is in much the better condition. Even if half the sum my figures show could be saved, it would make a great difference in the financial condition of the two farmers, and the succeeding ten years I think would, if the same systems were followed, show a still greater difference in favor of the man who cultivated the smaller area.

There is still one other way in which to look at this matter. I have already shown that the cost per bushel of grain decreases as the yield per acre increases. The same fact can be forcibly illustrated in another way. Our first farmer, we will suppose, plows and cultivates forty acres of land to raise six hundred bushels of corn and two hundred bushels of wheat, the other but twenty acres to secure the same amount. Now, at first glance one might think that the rent, the plowing, planting, cultivating, and harvesting of the extra twenty acres would represent the difference between the two systems, but looking with a little more care into the matter, we shall see that the extra twenty acres, if in grass or clover, will bring a good income with little or no expense. The twenty acres in grain will be more or less impoverished, while that in grass or clover will have grown a second crop below the soil to enrich the land and improve its mechanical condition, so that, instead of a diminished yield the following year, we can confidently look for an increased one.

Capital in Farming.—Perhaps there is nothing which so cripples the farmers of our country as the want of a cash working capital. A very large per cent of our farmers are in debt, and every spare dollar must go to pay interest or reduce indebtedness. I know this is an evil more easily pointed out than remedied, but I can at least protest against the practice so common among farmers of running in debt for more land as soon as they can see their way out of debt for what they have.

The farmer with a fair working cash capital has a great advantage over the one who is always cramped for money.

There are numbers of farms whose capacity would be doubled by drainage, whose owners, instead of investing their profits in this way, will buy out their neighbor, whose farm is in the same condition.

It often happens that the hay or corn crop is short, and a farmer has not enough to carry his stock through the Winter. If he has money to spare, and has good judgment to anticipate the coming rise, he can lay in a supply of feed while the price is low, but if he is cramped for cash, he may be compelled to sacrifice his stock or defer purchasing feed until the price has advanced so that he will lose money.

The season of 1881 illustrated this fully. Throughout the Mississippi valley a long-continued drought cut short the corn crop, so that it was evident to all that prices must be very high. There was plenty of old corn still in the country, which could be bought at from forty-five to fifty cents per bushel. Some farmers who had the money to spare bought a year's supply, and were enabled to fatten their stock and sell at high prices, but the majority of farmers had no money to spare, and bought a few bushels of corn at a time as they were compelled to, and before the crop of 1882 was fit for use they were paying one dollar a bushel for corn to feed their teams, or, what was worse, working them with no food but grass.

There can be no question as to which is the better off and able to farm best, and take the most comfort in life, the man with two hundred acres of land and in debt two or three thousand dollars, or he with one hundred acres and two thousand dollars cash working capital. I should strongly urge the farmer before buying more land or making any outside investment to see if he can not use the money to better advantage in his business, either in draining, fertilizing his land, improving his stock, or in some other way that will increase his comforts or profits.

Hired Help on the Farm.—The young farmer may for a while do without hired help, but if this is long continued he is likely to overwork so as to injure his health, and at the same time neglect many things that ought to be done. The team

must be kept at work, and at the same time there are daily calls for odd jobs, such as making garden, repairing fences, looking after the stock, going on errands to town, etc., and the farmer soon finds that both profit and comfort demand help. There often comes a time when, from previous bad weather or other causes, there is a large amount of work on hand which must be done at once or loss will ensue. At such times it is usually particularly difficult to obtain day labor, and the farmer who has a regular hand has a great advantage. The man who in addition to a full day's work in the field must attend to all the etceteras will soon become a mere clodhopper. He will be too tired to read, and will have no time to visit, and life will mean little more to him than drudgery.

On the other hand, if he hires a single man and boards him, he often imposes a burden upon his wife that she is scarcely able to bear. The duties of a mother who has the care of a family of little children are heavy enough at the best. If the boarding of a man in the family must involve the hiring of a girl in the house, it will often be cheaper to hire a married man who will board himself. If the man must be boarded and the wife is likely to be overworked, her husband should furnish her the assistance she needs. If he does not furnish a hired woman, he can at least see that she has wood and water in the kitchen, relieve her of the milking, churn, and carry the milk into and out of the cellar. This work he will have leisure for if he has a man to help him. I have usually found it as cheap, all things considered, to hire a man who boarded himself as one who boarded in the family. If you will give him a garden spot and pasture a cow for him, or, if he does not keep a cow, furnish him a few quarts of skim milk each day, and allow him the use of a house rent free, a married man can often be hired at the same wages that a single man will ask. A cheap, comfortable cottage on the farm for a laborer will often prove a good investment.

I believe that it is best for both parties to pay good wages. Cheap help is generally dearest in the long run, and the man who is jewed down to the lowest possible price in making a bargain will not be likely to serve you with the interest and

enthusiasm he would if he felt that you were liberal in your dealings with him.

Of late years I am very cautious about making a contract with a work hand for a specified time unless I know him thoroughly, for I do not wish to be obliged to keep a man who proves to be ill-tempered, immoral, or disobliging; so I hire a hand for a specified time, but insert in the contract that either may terminate the engagement on a week's notice. I state to the man frankly when I hire him what I shall expect of him, and tell him that I do not wish him to stay with me a day longer than he is well treated, and that I shall dispense with his services whenever our relations cease to be agreeable. There should be a form of contract or memorandum of agreement drawn up, to be signed by both parties, and in this every thing should be plainly stated, nothing left to memory. If your hand is a married man, and is to have garden, cow pasture, house rent, and other privileges, specify exactly what they are to be.

Some young men think that if they work through the day it is no business of their employer if they spend every evening at the village, and come into the house at midnight or remain away over night and get back after the feeding is done in the morning. A fair understanding on all these points, written out at the beginning, will go far toward preventing misunderstanding and trouble in the future. There are some kinds of work needed occasionally on the farm which can hardly be called farm work—for example, quarrying stone, ditching, and well-digging—and if you have not specified these in your memorandum, I think it fair that they should be done by help hired expressly for the purpose or extra pay allowed your hand if he does the work. There is no better rule in the treatment of employes than “do unto others as ye would they should do unto you;” if there is first a fair understanding between the parties and an approximate observance of this rule, there will be little trouble.

Some farmers have adopted the plan of giving a bonus for good behavior and faithful work, and have found it satisfactory. The plan is this: After the bargain is made, say for eight months at fifteen dollars per month, with a memorandum that the engage-

ment may be terminated by either party at a week's notice, you say to your hand, "If I find you faithful and obliging, at the end of your term I will give you ten cents a day extra for all the time you work, and as I shall not keep you unless you are so, the fact that you remain with me eight months will insure you this amount." You will thus give him a motive to do his best.

There often comes a time in the life of a farmer when he feels the care and burden of the farm to be too heavy for him. He has reached perhaps the age of fifty, is in comfortable circumstances, and feels that he has fairly earned something of rest. In many cases he rents his farm and moves to town. I think, generally speaking, he makes a mistake in so doing. A man who has been active and industrious up to this time of life will not be happy in idleness; the change in his life is too radical. Besides, he will soon find that his farm is running down. The tenant can not be expected to take the same interest in it as the owner. Stock will be allowed to tramp the fields when soft, fences will run down, a proper rotation will not be followed, and before long the farm will be reduced in fertility. In my judgment the best plan is for the farmer to remain on his farm, but he should be relieved from heavy labor and care much earlier than he usually is. The fact is that a majority of farmers work more hours in a day and harder than a day laborer, and keep it up till feeble old age, even though their financial condition is such that there is no necessity for it. Now, the remedy for this is renting, not the whole farm, but fields, to be cultivated on shares. I have never seen a neighborhood in which there were not men ready to take fields in this way. This leaves the farmer in possession of his house, garden, orchard, and pasture, and with full control of the farm as to what part shall be in clover or grass, and what in grain, and at the same time relieves him of the heavy work.

The terms of grain rent vary in different localities, but where I live there are two systems. One is for the landlord to furnish teams, tools, and seed, and feed the teams, and get two-thirds of the crop, and the other for the tenant to furnish these

and get half the crop. There is no settled rule as to whether the landlord is to take his wheat in the shock or bushel, or his corn in field or crib, but this is a matter of agreement. If the tenant has no privileges, he is usually paid for this part of the work, but where the landlord can furnish him a house, garden, and cow pasture, the tenant usually will deliver in crib or bushel the landlord's share of the crop. It is often best for the farmer to first try renting out his farm on the thirds till he sees how the plan suits him, for then, if he wishes to farm it again himself, he has his stock and tools. If he is pleased with the plan, he can in a year or two sell these and rent on the halves. The plan of renting on the thirds often gives some industrious, enterprising young man a chance to get a start in life and rise above the condition of a laborer, and I have been surprised to find so large a number of our best farmers who began life in this way. The first five hundred dollars I ever possessed I made by cropping on the thirds on my father's farm. I would urge this plan upon the prosperous farmer who has passed middle life, for to me there is no more pitiable sight than that of a man broken down with hard work when but little past his prime, painfully dragging through the heavy labors of the farm long after his financial condition is such that he can afford rest and recreation. To all such I would say, God gives a man but one journey through life, and if we make this life similar to that of a galley slave, we shall have no opportunity to go back and correct mistakes.

A careful study of this subject of farm management shows that brains on the farm count for more than muscle, and that success depends more on a systematic plan, wisely chosen and faithfully executed, than on physical labor.

CHAPTER II.

FARM FENCING.

THE history of farm fencing in our country is a good illustration of the force of habit. In all the timbered regions the question was, until recently, "How shall we get rid of the timber?" and as straight thrifty rail timber abounded and it seemed a pity to burn it, the farms were fenced into small fields, often from six to ten acres each; and now with the rail timber gone, and a good fence costing one dollar or more a rod, there are multitudes of farmers who still retain the small fields, and think they must replace every fence that was built in the early pioneer days.

I assert that half the fences in most of our States might be dispensed with and the farmers would be actual gainers. A few figures will show what a saving this would be. We will estimate that a fence will cost one dollar a rod—which is much less than a good post and board fence can be built for—and we find that to fence a farm of one hundred and sixty acres will cost as follows :

To inclose it,	\$640 00
To divide it into forty-acre fields,	320 00
To again divide so as to make twenty-acre fields,	320 00
And to make ten-acre fields,	320 00
Total,	<hr/> \$1,600 00

Even if we count that these fences would last twenty years, which is much longer than they will in most cases—all this heavy expense, as well as some additional for repairs, must be met again at the end of this time; and it becomes a problem of great interest and worthy of careful study,

How to Reduce the Cost of Fencing.—Three methods occur to me by which this expense can be greatly lessened.

First, by reducing the amount of division fences. Second, by good stock laws well enforced. Third, by adopting the cheaper styles of fence.

Under the first head we can make a great saving. I have on Eastview Farm for twenty years abolished division fence on all my best plow land. Here I have sixty-five acres in one field, and by agreement with my neighbor we have had no division fence between us, he having forty acres of his best land in the same inclosure. Neither of us ever turn stock on this land, but always cultivate or mow it, and I think it has been just as profitable to us as it would have been if divided into small fields. Moreover, the land has been mellow and in good condition to plow when the fields in my neighborhood that have been tramped over have been rough and cloddy. After this long experience I am prepared to recommend this plan of never pasturing the best plow lands of the farm.

Another way in which a great saving can be made is by fencing against cattle and horses only. There are farms by the thousand not adapted to corn, and on which but few hogs are kept, and yet every fence is pig tight and the extra cost of fences is more than all the profit on the hogs. I have found a two-board fence a perfect protection against cattle, while four or five boards are always used where a fence is made to turn hogs. To be sure, hogs need some green food, but it will be found much cheaper to confine them to a lot or single field and carry green food to them than to fence the entire farm. There are farms adapted to hogs or sheep, which must be fenced with reference to keeping this stock, but the farmer before deciding to fence against hogs should count the cost and see whether the extra expense of fences will not swallow the profits.

We already have in many of the States all the legislation needed on the question of stock running at large. In Ohio the law makes the owner of stock responsible for all depredations, and all stock can be prohibited from running at large whenever the law is enforced. It is a singular fact that the opposition to the law has come mainly from the farmers themselves, and there are still many localities where it is impossible to enforce it.

When we remember that ordinarily there is not more than three or four acres of grass-bearing land to the mile of highway, it will be seen how penny-wise the farmers are who insist on pasturing it. Even where it is desirable to keep all the land fenced, our stock is much more likely to break out if stock is feeding along the highway. In my own neighborhood the law is so perfectly enforced that for three years I have had no front gate, and stock coming in would have free access to over one hundred acres of land, several of which is cultivated in garden and nursery stock.

The June flood of 1882 in this neighborhood did more to secure the enforcement of the stock law than years of agitation would have done. Coming as it did within a week or two of harvest, and sweeping away more fence than was ever known to go in a single flood, it was actually impossible to replace it at that time, and all stock was shut up, and many of the farmers, finding that they could grow crops without fences—even along the streams where the extra amount of waste land made the temptation to turn stock on the highways greatest—have never replaced their fences and never will. This has relieved the owners of bottom lands from a heavy tax, for their fences are often swept away.

I would advise farmers everywhere to agitate this question of prohibiting stock from running at large. If your State has no law on the subject, petition for one. If you have a law, enforce it. One man can not do this alone, but whenever you can get a number of farmers to unite and post a notice that all stock running at large will be impounded, you will have no further difficulty.

The third method of reducing the expense of fencing by adopting cheaper methods, you will find illustrated and described under the appropriate heads of this chapter. It seems hardly worth while to devote space to the rail fence, for it is fast disappearing, and with the ever increasing scarcity of timber and the facilities for transportation afforded by our railroads, there are few localities where rail fences will be replaced.

Hedge Fences have been on trial for thirty or forty years, but are least in favor with the farmers who are best acquainted with them. When I meet a man who is enthusiastic in advocating the planting of hedge, I feel quite sure that he is a novice in the business, and that should I meet him ten years later I should find that his ardor had cooled considerably. I do not speak from theory on this matter, for I have had the constant care of from half a mile to a mile of hedge for over thirty years, and there is scarcely a farm in my neighborhood but has more or less of it.

There are locations where hedge is the cheapest fence that the farmer can have, and where it will give excellent satisfaction. For example, along the border of a permanent pasture, where the shade will do no harm, and you do not care if the view is interrupted, you can start a hedge, and need give it no care after it is large enough to turn cattle for a long term of years. In such a location I have known hedges to make a perfect cattle fence without any expense beyond planting and a little care for the first two years, and in twenty years they had grown large enough so that from six to twelve posts could be cut to the rod, and these posts are not excelled in durability by any timber in the world.

There is no trouble whatever in making a hedge that will turn cattle, and the cost is small. For a cattle fence I would set the plants eighteen inches apart. This will require eleven plants to the rod, costing about three cents. The cost of preparing the hedge row and setting out the plants will vary somewhat, but should not exceed five cents a rod, and the entire cost of a hedge four years old should not exceed thirty cents a rod, unless you must build a fence to protect it from the stock while growing it. The best way to prepare a hedge row is to plant it in potatoes the previous year. If the row crosses a poor spot, it is well to manure it. The hedge should be thoroughly cultivated for two years after planting, and should not be cut back till two or three years old; then cut to the ground, and let it make a new start, and it will grow dense enough to make a good cattle fence. Instead of cutting back, the hedge is often plashed, by

which we mean that the plants are bent down and twisted together so as to thicken the hedge at the bottom. I have rarely, if ever, however, seen a hedge made hog proof by this means. An English neighbor of mine has a hedge of which he has taken admirable care, having plashed it twice, but the hogs go through it, and as it grows older it will get worse. If you only want a hedge to turn cattle, no plashing will be necessary, as it will grow up thick enough for this purpose. If you want a hog fence I would advise that two six inch boards, or two barbed wires be used at the bottom.

The great objection to a hedge fence, except where it can be neglected as I suggest, is that it must be trimmed regularly and at the right time, or it is soon too large and out of shape, and becomes a nuisance; and as this work comes at a season when the crops demand all the time and attention of the farmer, it becomes a heavy tax. The only way to keep a hedge in good shape is to trim frequently when the new growth is soft, and this requires three trimmings a Summer. If neglected ten days after it should be cut, till the wood hardens, you can not keep a good shape to your hedge. Where you wish an ornamental hedge you should always trim with sloping sides, as a hedge with perpendicular sides is always more or less open. The best form is pyramidal, with a regular slope from the ground to the top. The best implement to trim with is the Dutch sickle, or grass hook. With a little practice one can trim as true with it as with shears, and very much more easily and rapidly. If trimmed at the proper time there will be no thorns scattered, for it will be done before they harden. When barbed wires or boards are to be used to make the hedge hog proof, they should be put in place when the hedge is cut back to the ground, so that in making the new growth a part of the shoots will grow up on either side, thus holding the boards or wires in place. The boards or wires should be secured to stakes driven along the hedge row. My advice to the farmer is, plant but little hedge, except in such places as you are willing to allow it to grow without the labor of trimming. Another way to reduce the cost of fencing is to plant a row of trees, and thus

Grow Live Fence Posts. These would not be suitable for all localities, as in places the shade would be objectionable, but some such lines of trees might be grown on every farm, and even though they occupy some land, they will grow into valuable timber, and will also make wind-breaks which will protect the crops and stock. I find on my limestone soil that the common black locust (called also yellow) is the best tree for this purpose. I planted a row fifty rods long in 1879, and as the Spring was very dry and unfavorable, and they made a poor growth, I cut them back to the ground in 1880. In the Spring of 1883 they were large enough to support panels of fence, but as we had one of the neglected hedges which I recommend, we cut it back and made a fence of the brush by laying one row along the row of locust trees, and another row on top of this with the brush locked between the trees, which were four feet apart. The labor of cutting and placing the brush cost us just four dollars, or eight cents a rod, for our line of fifty rods. I know this is not a handsome fence, but it is effective and will last for years by the addition of a few more brush.

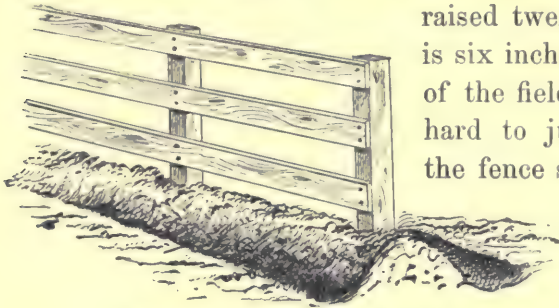
When you use the row of trees to support panels of board fence, you do not nail them to the trees, as this would injure them, and the swaying of the trees in the wind would break the nails. Nail your boards to oak or some other good timber to hold nails, and then set the panels up along the row of trees, drive a stake to keep the bottom in place, and secure the top by a piece of cheap rope, tarred twine, or wire. These ties will need inspecting annually, so as to see that they do not get tight and girdle the trees. If I was planting a row of locust trees again for this purpose, I would start them only two feet apart, and then would cut out for bean poles and fence stakes such as I did not wish to leave. In making these movable panels of fence, I nail the boards to oak two inches square, and find it strong enough. I do not call this a handsome fence, but every good locust post, well set, costs me thirty cents, and in twenty-five years will probably be past its usefulness. The tree and oak upright will not both cost above eight cents, and in twenty-five years the trees will sell for enough to build several new

fences of the same length. A neighbor of mine cut a row twenty rods long, and sold from it one hundred and ten dollars worth of posts. I think there are few farms on which there might not be grown profitably one or more of these lines of live fence posts.

Post and Board Fence is considered by many the cheapest and best in the long run, and if well built and of good material, it will last many years, with little or no expense for repairs. The cost of building a board fence is so great that one can not afford to use poor material. A sappy oak post that will rot off in from six to ten years will cost as much to set as a good locust or cedar, which will last from twenty-five to forty years. All posts should be well seasoned, set not less than thirty inches deep, and thoroughly tamped. There is some difference of opinion as to the best time to cut posts, but the weight of testimony is in favor of August, cutting when the wood is freest from sap and will dry out rapidly. There is a popular idea that a post set top end down will outlast one set as it grew, but experiment has, I think, failed to verify it. With good, thoroughly seasoned posts of our best timbers, I do not think any preparation for preserving them necessary, but with posts of inferior timber immersing in coal tar would probably be profitable.

There are two ways by which we may decrease the cost of post and board fence, one of which is by reducing the number of boards, and the other by increasing the distance between the posts. Not many years ago most farmers used five boards and sometimes a cap in addition, thus making a top-heavy fence, likely to be leaned and twisted by the wind when the ground was soft. Of late years it is seldom that more than four boards are used, however. I have for several years advocated, on all level land, a three-board fence, and some of our best farmers have adopted it, and find that it turns all stock perfectly. The plan is simply to nail the first board so that the bottom of it will be fifteen inches from the ground, and then plow a furrow or two each side and bank up under the fence. This leaves a shallow ditch each side, so that an animal coming up to it is in an unnatural position. They can not jump with the front feet in the

ditch, for they are too far from the fence, and if they come close enough to get their front feet on the bank, the hind feet will be in the ditch. Even if the bottom board of the fence is only

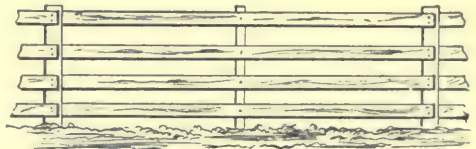


A THREE-BOARD FENCE WITH FILL.

raised twelve inches, if the ditch is six inches lower than the level of the field it makes a fence very hard to jump. The fill under the fence should be made broad, and both it and the ditch heavily seeded with grass. The distance apart of the

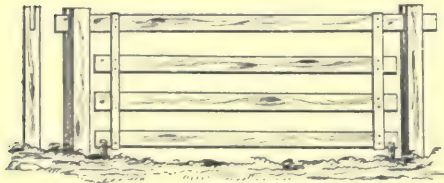
posts may be increased, and much time cutting and fitting the boards to the posts saved by nailing the boards to both sides of the posts.

The illustration gives a good idea of how this is done. The posts should be set about six inches closer together than the length of the boards, so that you will not need to nail close to the end of the board, there is then less danger of splitting out and the boards hold to the post better. With a twelve-foot board, a cheap stake of lasting timber, or even a three-inch strip of oak board in the center of the panel to stay it, makes a very good fence.



BOARDS NAILED TO BOTH SIDES OF POSTS.

It is a good plan to have a movable panel in every line of board fence, even in those between neighbors, as it is often



A MOVABLE PANEL.

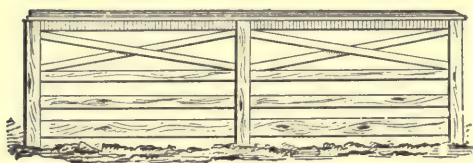
very convenient to be able to get through with the wagon, plow, or mowing machine. How these movable panels can be made is shown in the illustration. You will notice that the top board of this

panel projects a few inches and drops into the slot made by sawing into the top of the posts. The slot is shown in the post

at the left. The slot to receive an inch board should be one and a fourth inches wide, so that the panel can be lifted out without binding. A pair of good stakes should be driven in the ground at each end, to prevent the panel swinging back and forth when the wind blows.

Where a board fence is built along the front of the farm,

and it is desirable to make a neat, tasty fence, it will add to its appearance to put two three-inch strips, crossing each other as shown in the cut. A fence made in this way, of dressed



A NEAT BOARD FENCE.

lumber, and well painted, will by many be preferred to a paling fence, which will cost much more money.

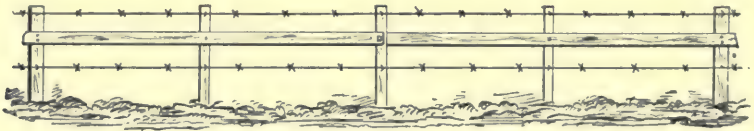
Wire Fences are now fast superseding all other kinds in many parts of the country, particularly in the prairie States. The barbed wire fence has its advocates and also many who oppose it as dangerous to stock. There is no denying the fact that valuable animals have been ruined by it, and I would advise that there should always be one board used with the wire, as this will enable the stock to see the fence and they will be much less likely to run into it than if wire alone was used. As an additional precaution, introduce your horses to the fence before you turn them out. Lead them up to it and let them feel the barbs, and their natural instinct will cause them to avoid it. I think one runs a great risk in turning a playful horse out where there is a barbed wire fence without taking this precaution.

There are two facts connected with wire fence which make it very much cheaper than post and board fence; these are that the posts may be much farther apart, and that a cheaper quality of posts can be used. It is very difficult to use 'crooked posts in making post and board fence, as the boards will need to be cut to different lengths to fit them, but for wire fence a crooked post is as good as a straight one, and it can usually be bought for half price. I am hardly prepared to state what is

the best distance apart for posts for a wire fence, as I have seen them all the way from eight up to fifty feet or more. I believe, however, that a good post every two rods, with two or more stays of some kind between, will be found sufficient. I think that if a strip of board, of hard wood, three inches wide and one inch thick, is used every six feet and the wire stapled to it it will support the wires sufficiently.

I think a combined wire and board fence will be found cheap and satisfactory, and where only a cattle fence is needed, two wires and a strip of board three inches wide between them is all that will be required. The two wires alone will turn cattle, but the strip of board renders the fence safer. There is probably no stock worse to fence against than town cows, and the college campus in my village has been fenced with two barbed wires for several years, and I have never known the cattle to trespass.

My plan of making this fence with the three-inch strip of board is this: Set the posts a little less than thirty-two feet apart, so that when one end of a three-inch board sixteen feet long is nailed to each post the other ends will lap a few inches. Be-



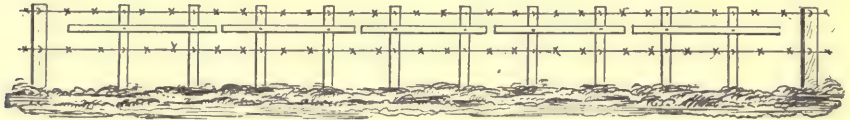
WIRE AND BOARD CATTLE FENCE.

tween the ends of the boards, set up a three-inch strip and put a carriage bolt with washers through both boards and the upright. Then use one more of these uprights for each board. These uprights should rest on a flat stone or block. The cost of this fence would be about as follows for each panel of nearly two rods:

One post set,	30 cts.
Four pounds of barbed wire,	28 "
Five upright strips four feet long and three inches wide,	12½ "
Two boards three inches wide and sixteen feet long,	16 "
Bolt, staples, and putting up,	12½ "
Total,	99 "

or about fifty cents per rod. This cost could be materially reduced in many cases, as I have figured every thing at retail prices. I recently bought a lot of large split locust posts for this purpose at half price because they were crooked.

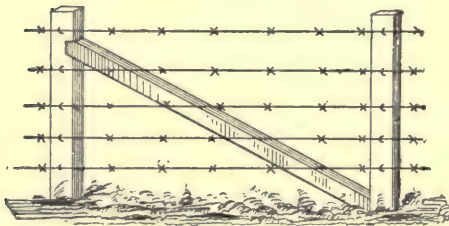
I have recently examined a combined fence which is giving excellent satisfaction, in which the posts are sixty-six feet apart. Sawed oak stakes two inches square are driven a foot



FENCE WITH POSTS SIXTY-SIX FEET APART.

into the ground every six feet and the wires are stapled to these stakes, and between the two upper wires a strip of board three inches wide is nailed to the stakes. These are not continuous, but each board is nailed to two stakes and is independent of the others. This fence looks well and turns stock perfectly.

In making wire fence of any kind the end posts must be thoroughly braced. Set large posts deep and firm for the ends, and at the distance of eight or ten feet from them set others. Then cut a notch near the top of your end post, and cut your brace so that the bottom will set



HOW TO BRACE A POST.

against the second post, just below the surface of the ground. This brace should be of lasting timber and well fitted.

There is another form of combined wire and board fence being built which turns all stock even pigs. In this fence two boards are used



COMBINED WIRE AND BOARD FENCE.

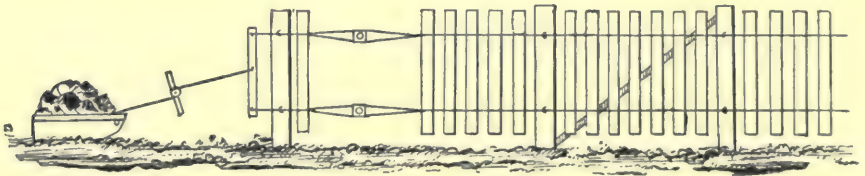
at the bottom and two barbed wires above. With this fence only one long post is needed to each two panels of fourteen or sixteen feet each. A short post, projecting two feet above

the ground will be needed to splice the boards on, while a good stake in the center of each panel will be all that is required.

I estimate the cost of this fence to be about forty cents a rod less than that of a four board fence with a post every eight feet. I would nail the bottom board eight inches above the ground, and bank up; then a four-inch crack between the two boards and this would bring the top of the second board two feet above the level of the ground. Put the first wire eight inches above the board and the second sixteen inches above the first.

As plain wire costs but half as much as barbed, and is perfectly safe, it is preferred by many for fences. I have seen a fence of this kind made with seven wires, and posts thirty-six feet apart with an upright of inch board stapled on every four feet, and the owner assured me that it turned all stock. The saving in the cost of wire over boards would be about twenty-five cents per rod, and the saving in posts would be considerably more than this.

Next we have the wire and slat fence, which is economical from the fact that refuse lumber can be used in making it. Old



WOVEN-WIRE SLAT FENCE.

boards which have been used until rotten at the post so that they will no longer hold nails, are often sound between the posts, and can be cut up and used in this fence and will last for many years, or the farmer with timber that will split freely—oak or hickory is excellent—can rive out slats. It is sometimes made with boards but three feet long and a barbed wire stretched above it. In making this fence, slats of any width from two inches up to six or eight may be used. Two plain wires are stretched eight inches above the ground and two

others about thirty-two inches higher up. These are not stapled to the posts but are stretched tight enough to keep them to their place. As the tension will need to be changed as the



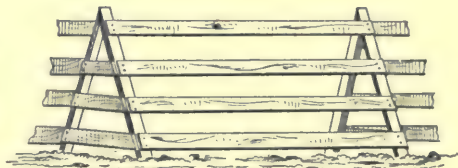
LOOM FOR WEAVING IN SLATS.

work progresses, it is a good plan to attach the wires to a sled loaded with stone, and by moving the sled either way the tension can be increased or lessened. It is advisable that the wires run on the side of the posts next the prevailing winds. After the wires are in place the slats are woven in by means of a simple implement called a loom, and shown in the cut. It will be seen that by taking hold of the lever at the top and giving a half turn the wires will be made to cross each other, and then by reversing the motion you cross them back again.

The secret of making a good fence of this kind is to have every slat driven tight and snug, so that the cracks are of uniform width and there shall be no chance for a slat to work loose, for if one slat gets out it allows the rest to slip, and the fence soon becomes shaky. A friend of mine who was inexperienced in making this fence, thought he could save a slat at each post, and so left wide cracks where the fence passed the posts, and soon found it coming to pieces. For the same reason the slats should be seasoned and dry. If you make the fence of green lumber the seasoning process will be likely to shrink them so that the fence will become loose, and the slats work out. After the slats are woven in you attach the fence to the posts by passing a loop of wire around each post at the top, letting it cross the two wires through which the slats pass, including one slat, and securing it by a staple. Where a crack comes opposite a post, so you can staple the wires to it, do so; and whenever a slat comes fairly against the post put in one or two good fence nails. It is a good plan in building this fence to have a piece of board on the ground to set the slats on, so as to keep the fence level. It seems to me that with these instructions a novice can successfully build this fence.

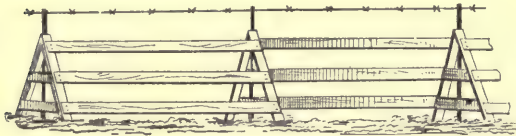
Portable Fences.—One great need for the farm is a really good portable fence, which can be taken down and set up easily and rapidly, without injury to the panels. The man who will give us such a fence will deserve the gratitude of farmers. I have never yet seen a portable fence that was free from serious objections. Either it would blow over in a gale, or it was made zigzag, and occupied as much space as a rail fence, or it must have ground sills, keys, and braces which were in the way or liable to get out of order, or worse still, as is often the case, had no merit or value except that it paid the patent-right man a fee. I think that during the last thirty years half the farmers of my acquaintance have bought the right to use some kind of portable fence, and a search through a township would not ordinarily result in finding a quarter of a mile of it in use. In 1878 I invented what I call a

Self-supporting Truss Fence.—I have had this fence in use ever since on my farm, and for certain purposes I like it well, and it has grown in favor with me each year I have used it. The principle of this fence, as you will see from the cut, is that one panel supports the other. I first tried making it with oak pieces three inches square for the uprights, and with panels fourteen feet long. I found it was heavy to handle, and that the boards would sag in the middle. I now make it with oak uprights, two inches square, and panels eight feet long. These panels are light and easy to handle, and stand much firmer than if made longer. In exposed situations, when I used the longer panels, this fence was sometimes blown down in a gale, but I have never had the eight-foot panels blown over, although I have for two years used it for a barnyard fence, where it is five feet high. In all exposed situations, I would recommend an occasional stake, as the cost would be very small and the advantage great. All that would be necessary would be to drive a stake in the notch once in two rods, or every fourth panel, and drive a fence



SELF-SUPPORTING TRUSS FENCE.

nail through the board into it. The cost of this would not exceed a dollar and a half for forty rods of fence, as it would require but twenty stakes, worth not more than five cents each, and they could be driven down in two hours. A still cheaper way to guard against wind, is to drive short stakes against the brace boards, near the outer part of the upright. Let the stake come up a foot above the ground, and drive a nail through it into the upright. When this fence is to be put up to stand some



TRUSS FENCE WITH STAKES AND WIRE.

years, I would recommend that it be made but three boards high, and that a barbed wire be stretched over it, and

fastened to the stakes. There would only need to be posts used at the ends, as the stakes set in the notches would be held firmly by the fence which would be nailed to them. If before setting up this fence a few furrows were thrown together so as to raise the land six inches above the level of the field, and leave a shallow ditch each side, I think that three boards and a wire would turn a breachy mule.

This fence is not strictly portable, but it can be taken apart and moved without disturbing the panels, and quite rapidly. We do not fasten the tops of the uprights together at all, as we find that the short brace-boards nailed to the uprights hold it perfectly. If you are putting up the fence for temporary use, I would not nail it to the stakes at all, but would drive them on alternate sides, and one to every sixteen feet. In this case cheap stakes would be sufficient, as there would be no danger of their rotting off.

One great advantage of a fence of this kind is that it can be made in the barn or shop during the leisure of winter or on stormy days when outside work can not be done, and it can be set up when the ground is frozen, or when so wet that it would be impossible to dig post holes and set posts. Even if you make the fence full height without the wire, it will take but three feet of lumber for the uprights for each panel, and this costs you but one-third as much as a good post. We also save

the expense of digging holes and setting posts, and, besides, gain the advantage mentioned above, of doing most of the work in bad weather. I have never put up a long string of this fence at one time, but I know that two men can set up a quarter of a mile of it in a day. The cost of the brace-boards will be very little, as they can be cut from waste lumber. In making this fence you will want a mitre-box for sawing your uprights. The tops of the uprights should fit exactly when the panels are set up, so as to give the proper spread at the bottom.

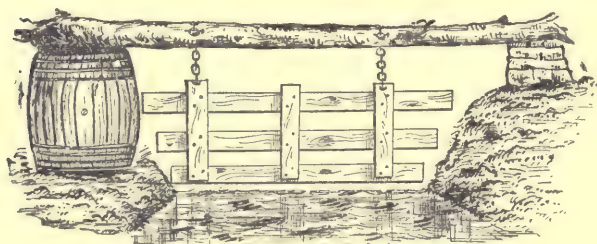
For a three-board fence that is to have wire and stakes to complete it, two feet will be ample spread for the bottom. My barn-yard fence, which is five boards high, has a spread of three feet. You will measure carefully, and get your first panel squared and spaced exactly right, and then use it for a pattern, laying the cross-pieces and boards exactly above the ones on your pattern.

When you wish to move a line of this fence, loosen one end, and take it apart by lifting the panel and twisting it around at right angles with the fence, as in this way you will break the nails without splitting so many of the brace-boards. I should not consider it expensive to move the fence, however, if you split half of the short boards, as new ones would cost but little, and the split pieces would be worth nearly cost for kindling. In sawing the brace-boards you will save lumber and work to reverse the board each cut. I think the cost of moving a fence of this kind, even if new brace-boards must be furnished, would be less than to move a rail-fence of the same length. The bottoms of the uprights can be placed on a flat stone, or piece of board, to keep them from decay. I feel quite sure that, if farmers will give this fence a trial, they will find it cheap, and, in many places, the best fence they can get for the money.

Fence Rows.—There are many farms marred by the neglected fence-rows, where sprouts and briars hold undisputed sway. These should be cleaned out, and kept cleaned, and in doing this, “a stitch in time will save nine.” Do not wait till a wilderness has grown up, but go over the row, spring and fall, and cut or grub whatever has made its appearance. Line-fences

are most often neglected in this manner. If you have any such, make an arrangement with your neighbor by which the fence shall be set over a few feet, one way or the other, till the row is cleaned out and the briers and weeds thoroughly subdued, when it can be put back. Whatever other fences you neglect, be sure and keep good line-fences, for this goes a great ways towards making good neighbors. If, by accident, your neighbor's stock trespasses on you, try and keep your temper, for to lose this often involves the loss of a friend, and causes years of unhappiness. If your stock trespass upon your neighbor, offer to pay him the full damage, and do your best to prevent a repetition of the offense.

Water-gaps and Flood-gates are on many farms a great vexation to the fence-builder. Where the banks are high and firm enough to support a pole, and not so far apart but that one can be found to reach, it is not a difficult matter to put up



A GOOD WATER-GAP.

a swing-gate; but, when abutments must be built, the difficulty is greatly increased. I have hit upon a plan for an abutment which is cheap and dura-

ble, and in many cases will answer the purpose admirably: Get an oak hogshead, such as is used for shipping crockery; take it to the blacksmith's, and have it hooped with old wagon-tire, and place it where you need the support for your pole. In some cases you will need to dig a little to settle it, or, if the bottom is sandy or mucky, to drive a row of stakes around it, at a little distance, to protect it. After it is in place fill it with stone. If your abutment needs to be higher than the hogshead, you can build flat stone up two or three feet above it. If you wish to make it extra strong and permanent, mix thin mortar—one part lime to four of sharp sand—and pour it in to fill the interstices and bind the stone together. Such an abutment is cheap, and the rounded surface of the hogshead presents but

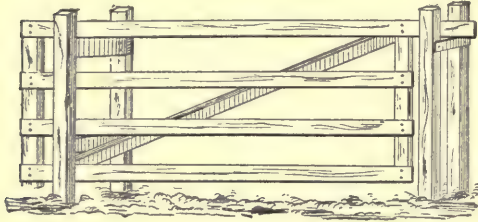
little resistance to the water, and, unless undermined, it is not liable to be washed away.

The best way I have found to attach the gate to the pole is shown in the cut. Use oak pieces, two by four inches, for the uprights; bore an inch-hole near the top to pass the chain through, and suspend them with chains. The pieces need not be more than four feet long, and the chains must suit in length the distance from the pole to the bed of the stream. After passing them through the uprights the chains should be attached to the pole by driving large spikes through a link into it on the lower, or down-stream, side. The chains must then pass over the pole, and hang down on the upper side. This will make them draw across the pole, and relieve the strain on the spikes. Before putting up the uprights they should be bored, with a three-eighth bit, where the boards are to go on. Place the boards on the upper side, and bolt them with strong carriage-bolts and good washers. If the gap is one where there is a swift current, and likely to be much water, it is best to use oak boards. It is cheaper, in the long run, to pay two or three dollars for a good locust pole than to take a sappy elm, or some other timber that will soon rot. Where only cattle are to be fenced against, barbed wires may often be stretched across a stream, and will make the cheapest and best fence in such a location.

Farm-gates.—It is not as common as it was a few years ago to see rickety bars in use on the farm, or, what is worse, a panel of rail-fence opened to get into a field; but gates are not yet as plenty as they should be. There should be a gate of some kind in every line of fence, so that you can always get from one field to another without going too far out of the way, or having to open a fence.

Our illustration shows what is called the lift-gate. These have come into general use, and have almost entirely superseded bars, and are a good substitute for other gates in all places where a gate will only be used one or two days in a week. It should always be made of the lightest material consistent with strength. There should be a piece of board, one or two feet long, under

the end of the gate, which you swing around, and the other end should rest on a round stick, as there will be less friction as it pivots around. Two of the boards should project four inches at the end of the gate you open, so as to pass between the stakes



A LIFT-GATE.

and hold the gate to its place. In opening this gate you slide it back till clear of the post or stakes, and then carry the end around while the other pivots between the stakes. You will notice that, at the hinge

end, the stakes are not set opposite each other, but angling. This is to enable the gate to be swung open without binding.

There are some places on every farm where good, permanent gates will be needed, and these should be well made, of good material, and well hung to a good post, firmly set. It were better to make a lift-gate than to hang a gate to spindling-posts, so set as to lean out of perpendicular as soon as the ground becomes soft, or to put up a gate made of soft lumber, badly braced, and so put together as to become loose and rickety in a few months. I would recommend that the lumber for a gate be thoroughly seasoned and planed. The cheapest and best way to make it is to bolt it together, using washers with the bolts. Use long strap-hinges, and put an extra strip on the gate where each hinge goes to bolt the hinges to. Before hanging give the gate two good coats of paint. To make a gate in this way no mortises will be needed, but I would recommend hard wood for the slats, which take the place of the uprights in the framed gate. When the gate is hung, put up a post, or strong stake, for it to swing against when open, and have a strap or hook to fasten it, so that it will not blow against your team or wagon-wheels as you pass through on a windy day. Always arrange a rest for the gate, so that, when open or closed, the weight will not hang on the hinges, but rest on the bottom. This rest may be a smooth stone or a piece of scantling, and should be placed so as to slope a little towards the gate, so that it will gradually receive its weight.

This plan, which will not take five minutes to arrange, will relieve the gate and post of much strain.

Wherever a permanent gate is needed it will pay to have a good post well set. It is of more importance to have it of good size below ground than above. A locust tree that will square six or eight inches, dug up by the roots, will have a base large enough to set firmly. It should be put in the ground not less than forty inches and well tamped. Always hang the gate high, not less than eight inches above the level, and then with broken stone and fine gravel make an easy grade on both sides to the gate. This will prevent it from dragging or being impeded by snow and will insure a solid road-bed through the gateway, and drainage which will lead the water away. I think that nine gates out of ten are hung too near the ground. The best fastening for a gate is a wooden latch made of hard wood and so hung that, whenever the gate is swung to, it will spring into the mortise in the post made to receive it.

A gate properly made, well hung to a good post, with a well graded roadway, will cost quite a sum, but will last for years and be a comfort every time you must pass through it; and counting time lost and repairs, the gate illy made and badly hung, which must be dragged around through a mud hole, will cost more in the long run. I find it a decided advantage to have small gates at the barn-yard to pass through to milk and feed, and to turn the cattle in and out. For this purpose a gate three and a half feet wide is as good as a wide one and is much easier to handle and not likely to get out of repair. By having gates of this kind at the barn-yard, lift-gates can be used for the wagon-way.

CHAPTER III.

FARM DRAINAGE.

IT is a fact well known to the farmer that uniformly good crops can only be grown on a well drained soil. While a good start has been made in the drainage of our farm lands during the present generation, it is only a start, and there yet remains in all parts of the country much land which would be improved by drainage. Probably, under a better system of farming, we shall see much of our upland drained which is not at present thought to need it. A large per cent of our uplands are retentive of water, and slow to dry out in the spring, so as to be in fit condition to work, and the farmer must often wait till the cool, favorable weather of April has passed, and hot weather has come, before he can plow these lands. Under these conditions his team suffers with the heat and heavy work of breaking the land, and, without great care and labor, it is likely to dry and bake in bad condition, so as to render it impossible to grow a heavy crop.

Advantages of Drainage.—Farmers who have drained extensively have found many benefits from it which would not be thought of by those who have no practical experience in the matter. Dr. Townshend, who was one of the first farmers in the West to drain with tile, gave in a lecture on this subject the following points of advantage gained by thorough drainage.

1st. It deepens the soil.

2d. It prevents the killing out of the best grasses and the bringing in of sedges in their place.

3d. It makes the land warmer.

4th. It improves the texture of soils.

5th. It enables us to work our lands much earlier in the spring.

6th. It prevents washing and waste of manure.

7th. It prevents wheat and other winter grain from freezing out.

To these I would add that it prevents failure of crops in excessively wet seasons, and enables them to endure drought better.

It also saves time, as the farmer whose lands are drained can not only work them earlier in the spring, but also gain a day or more after each heavy rain.

How Drainage Helps the Soil.—To understand how drainage can accomplish all the points claimed above, some of which seem to be incompatible with each other, it will be necessary for us to consider some of the characteristics of the soil and the conditions of successful plant growth.

No soil can produce useful crops when it is permanently saturated with water. Even the cultivated grasses will perish, and nothing but reeds, rushes, and sedges grow.

The best condition of soil for plant growth is that in which the particles of soil are moist but with no standing water between them.

Our figures show the difference between dry, wet, and drained soils as seen under a magnifying glass. A soil is made up of small particles thrown together miscellaneously, having small spaces between them, like a sponge. There are also small pores and cells in the particles themselves. Fig. 1 shows a dry soil, there being no moisture either between the particles or in them, but all the cavities filled with air alone.

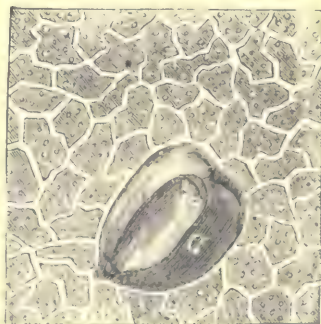


FIG. 1.—DRY SOIL.

As moisture is a prime essential for the growth of plants, it is evident that the seed *a* can not germinate nor plants grow in a soil in this condition. Fig. 2 shows a block of soil saturated with water, and here both pores and cells are filled with water. In a

soil in this condition no cultivated plant can long grow. Fig. 3

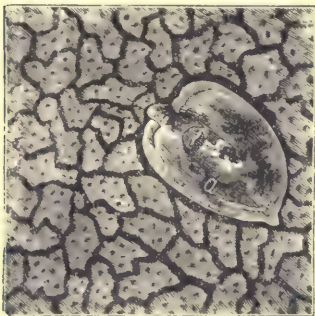


FIG. 2.—WET SOIL.

shows the condition of a drained soil; you will notice that while the pores in the particles are filled with moisture, the spaces between them are filled with air, and this is the best condition for plant growth, for the roots have access to both air and moisture, and these are neces-

sary to produce the chemical changes in the soil which prepare the food for the plant. Soils vary greatly in the amount of water they will hold by absorption, and a well drained soil is not necessarily a dry one. Careful experiment has shown that one hundred pounds of soil would retain the following weight of water which would not flow off by drainage.

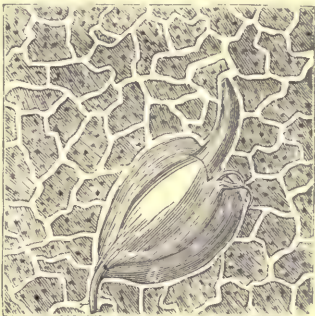


FIG. 3.—DRAINED SOIL.

Sand,	25 lbs.
Loamy soil,	40 "
Clay loam,	50 "
Pure clay,	70 "
Garden mould,	89 "

Having seen why a drained soil furnishes the most favorable conditions of plant growth, let us look in detail at the points of advantage claimed for it.

Drainage deepens the soil by allowing sun and air to penetrate it, and thus chemical action is induced. Every intelligent farmer knows that a crude and unproductive subsoil, when brought to the surface, is soon changed in color and texture by atmospheric action, and, although at first nearly barren, will finally become fertile. An excellent illustration is furnished by the brick-yards of my locality, where the subsoil is a stiff, reddish clay. I have known all the soil removed, and a field to lie barren for a few years, but finally to become productive from

the chemical changes wrought upon it. Precisely this is accomplished in the soil by drainage; for, as we lower the water-line and admit the air and warmth, this chemical action is induced.

Still another way in which drainage deepens the soil is by enabling the roots to penetrate the subsoil, and by their decay they form *humus*, which is one of the most important ingredients of a fertile soil. The character and value of *humus* will be explained in another chapter.

The fact is well known to every observant farmer that only the sedges and coarser plants will flourish on a soil saturated with water. The growth of flags, sedges, skunk cabbage, etc., is one of the signs nature hangs out, like a flag of distress, to show that the land needs to be drained. When such soils are drained, these worthless plants die out, and are replaced by those of value to the farmer.

Underdraining makes the land warmer, by admitting the warm air to the soil, for, as nature never allows a vacuum, as fast as the water is drawn off, the air penetrates and warms the soil. A dry soil is warmer than a wet one, because evaporation is avoided. Science teaches us that the evaporation of one pound of water requires more than five times as much heat as would be needed to raise the same amount from the freezing to the boiling point. We have many illustrations of the truth of this, as, for example, the water in a jug will remain cool as long as it is kept wrapped in wet flannel. Perspiration on the body, by its evaporation, keeps us cool, and enables us to endure heat that would soon be fatal if it were not for this wise arrangement of Providence.

If the water which falls upon a field must be removed by evaporation, it is easy to see that the heat which otherwise would warm the soil, and fit it for pushing the growth of plants, must be expended in evaporating the water.

Many tests have been made with the thermometer, and the temperature of the drained field has been shown, during the spring, to be several degrees higher than that of the undrained. A drained soil can be plowed much earlier in the Spring than an undrained one, and, as a loose soil admits sun and air, and

warms up much sooner than a compact one, we see another reason why the drained soil is warmer.

Drainage improves the texture of the soil, as already indicated, by allowing greater chemical action, and by producing a better mechanical condition, and also because, by lengthening the season, it enables the farmer to prepare his land more thoroughly. In other words, a well-drained soil will not only be found in such a condition that the work of preparation will be more effectual, but, as the work can be begun earlier, the farmer will not only have more time in which to do it, but more favorable conditions.

If the plows can be started in March, and the breaking finished early in April, the weather will usually be cool, and the work much easier for the teams. Land plowed at this season does not dry and bake quickly, as when it is done later, after the hot weather comes. It also undergoes some changes, which make it crumble more readily, and the farmer whose land has been plowed early has abundant time to pulverize his soil and get it in good condition. All these causes combine to give a better condition of soil on the well-drained farm.

It is difficult to estimate the importance of the lengthened season which drainage gives. For several years business led me to travel the length of Ohio, from north to south, in early spring, and the contrast was striking. Several counties through which I passed in the south-western part of the State are naturally and artificially well drained, and here the spring work would be well advanced, gardens made, oats coming up, and most of the corn land plowed. When I reached the flat counties, where little, if any, attention had been paid to drainage, often as late as the first of May not a furrow had been plowed, and water would be seen standing on the fields, and the outlook was most discouraging.

The effect of frost is disastrous on undrained lands, both in spring and fall, as the land cools so rapidly by evaporation that the fruit and gardens are often killed on such lands when they do not suffer at all on drained lands. Thus the season is shortened at both ends. My garden, which is thoroughly

underdrained, is an excellent illustration of the effect of drainage in lengthening the season and enabling plants to withstand cold. I usually find it dry enough to work the last week in February or first in March, and though mercury often goes down to within ten degrees of zero after it is planted, I have never lost hardy vegetables, such as peas, cabbage, beets, etc. In the fall, also, corn, tomatoes, and lima beans usually remain green for weeks after they are killed on flat, wet lands of the neighborhood.

On soils well underdrained, there will be less damage from washing and less waste of the manure dropped by the stock, for the earth will take more water and less will run off at the surface, and water that percolates through the soil, leaves much fertilizing material which would be lost if it flowed off in the runs.

Drainage prevents winter grain and clover from freezing out, for this is not ordinarily caused by simple cold, but by the expansion of the soil, which freezes when full of water and breaks the roots, thus destroying the plants.

The claim that drainage prevents failure of crops in both wet and dry seasons may seem paradoxical, but a little study will, I think, make the matter plain. It is easy to understand how it helps land in a wet season, but to many it is not so clear how it will help in a dry season. It enables the farmer to thoroughly pulverize the soil. A fine surface acts as a mulch which retains the moisture; also, by capillary attraction it draws moisture from below. This principle of capillary attraction is illustrated by the lamp-wick which draws up the oil. Our most severe droughts often follow exceedingly wet weather, and the land saturated with water can not be mellowed in time, but bakes and dries and ruins the crop. On the other hand, the drained soil discharges its surplus water through the drain much quicker, and leaves the land in better condition, and it can be planted or cultivated enough sooner, so as often to make all the difference between a good and poor crop. On the drained soil the roots will extend to a much greater depth, thus enabling the plants to endure drought much better than if they were near the surface.

When to Drain.—On most soils the best time to drain will be in the early spring, when the land is wet enough to spade easily, and the water will follow in the drain, but the work may be done in autumn, or at any time during an open winter. When draining is done in the winter care must be taken to lay the tile and cover it as soon as possible, or the freezing and thawing of the banks will cause them to cave and obstruct the drain.

What Lands need Draining.—The first land the farmer should drain, if he can not be at the expense of a general system of drainage for his farm, is the swales or low places through his cultivated fields. On many of our best upland farms these are quite common, and they usually angle through the fields, making them a bad shape and causing quite a loss of time in cultivating, and become nurseries of foul seeds. These swales are often found on farms which are otherwise comparatively dry. There is usually sufficient fall, and they can be cheaply and easily drained, and I have often known the entire expense paid in a single crop. There was on Eastview Farm when I bought it one hundred and fifty rods of these swales, too wet to be cultivated, and in the spring of the year often too soft to cross with a wagon. They grew only flags and sedges, and as they angled through my best fields with a width varying from two to six rods, it is easy to see how great a disadvantage they were to the farm. By draining these, from three to four acres of the best land on the farm was rendered productive, and as, in favorable years, it has produced thirty bushels of wheat, or eighty of corn, to the acre, and the entire cost of draining was less than one hundred dollars, it can be seen that it has been largely profitable. Before laying tile in these swales, a careful examination of the adjoining lands should be made to decide whether, at some future time, it will be profitable to drain them and use these drains as mains, and if it is probable that this will be the case, tile large enough to receive all the water that is to be brought to them should be laid.

Most flat lands under cultivation, which are not underlaid with gravel, will pay for draining, as the natural drainage is too

slow in the spring to fit them for the growth of plants as early as they ought to be planted. Without drainage there is often a temptation to plow and cultivate them too wet, and this results in poor crops and permanent injury to the soil. I have little doubt that it would be found profitable to drain all lands having a stiff subsoil in which, during the spring, or after a rain, the water collects if a hole two or three feet deep is dug. It will often be found profitable to underdrain even rolling lands. It is, of course, wise for the farmer to drain first his wettest lands, such as without drainage will not produce grain at all; but after this is done he should experiment with his drier lands, and see if he can not invest his money better in draining them than in something outside of his business.

The size of tile to use is a matter which will require good judgment, and I do not think any general rule can be laid down, for where there is a heavy fall a tile will carry considerably more water than where the fall is slight. If the tile is laid deep it will not need to be so large as if shallow, for the land will hold a large amount of water, which will not, for a time, interfere with the growing crops, and we can, therefore, take a longer time to remove it.

From Mr. Billingsly's work on drainage I copy the following: "For drains not more than five hundred feet long a two-inch tile will drain two acres; a three-inch tile will drain five acres, and should not be of greater length than one thousand feet; a four-inch tile will drain twelve acres; a five-inch tile will drain twenty acres; a six-inch tile will drain forty acres; a seven-inch tile will drain sixty acres." This calculation is made for a drain three feet deep, and for flat lands, with three inches' fall to the hundred feet. Where a fall of from eight inches, to a foot could be had in this distance, the carrying capacity of the drain would be increased one-third or more. The longer the drain the larger tile will be needed, the grade being the same. The size of the tile may diminish toward the upper end of the main drain, as the amount of water will be much less. In determining the size of tile needed it should be borne in mind that the capacities of tiles laid upon the same grade are to each other

as the squares of their diameters. Thus the capacity of a two-inch tile is to that of a four-inch as four to sixteen. I would not advise the use of smaller tile than three-inch, except for short laterals. It is better to err by laying larger tile than are needed than smaller, for in this case the only loss is the extra cost of the tile, while if those too small are used it may involve the taking up of the entire drain."

While general directions can be given, the intelligent farmer will understand that they must be varied to suit the circumstances by which he is surrounded.

The work of drainage should not be entered upon without careful planning and forethought, as it is costly, and, unless properly done, will not prove a profitable investment.

There are many farms where the fall is so good that the farmer will need no assistance from an engineer, as the lay of the land will show where the mains and laterals are needed, and it will be an easy matter to lay out a system of drains.

On other farms there may be but little fall, and difficulties to overcome which will require skill and experience. Under these circumstances it would be folly for the inexperienced farmer to trust to his own judgment, but he should employ an engineer, and have the work all mapped out for him, and the grades established. A map of the drains, which will enable the farmer to locate every line of drain on his farm, should be carefully preserved, as it may be of great benefit in case of any obstruction which will render it necessary to take up a section of the drain.

Material for Drains.—All sorts of make-shifts have been resorted to in underdraining. Stone, gravel, boards, rails, brush, etc., have been used and recommended, but nothing has stood the test of time but tile. These should be well burned, so as to ring when struck with a piece of metal, and should be made from good clay, and be smooth inside, so as to offer the least resistance to the flow of water. Reject all that are soft or much curved, or twisted out of shape by excessive heat in burning. The best shape for tile is round inside, and either round or hexagonal outside, so that they can be turned any side up in

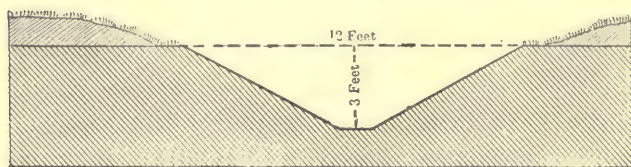
laying, as this will enable you to lay them more easily, and gives greater capacity for the material used. Some tile-makers make tile with a flat bottom. These are not only more difficult to lay than the round, but are more likely to become obstructed, as the broad, flat channel offers better facilities for the deposit of sediment.

There has recently been introduced a concrete tile which is made in the ditch by a simple machine. This method of draining promises well, but has not yet been introduced or tested sufficiently to enable me to pronounce upon it. The tile is made of the best quality of hydraulic cement, lime, and coarse sand. These are mixed so as to make a stiff mortar, which is fed into the machine through a hopper, and comes out at the rear of the machine a continuous pipe, smooth inside and out. By means of a trowel made for the purpose, this is cut into sections of any desired length, in such a way as to leave the bottom continuous, and give sufficient crevices to admit the water. The pipe will harden in a day so as to bear the weight of the earth used in filling. When hardened this tile appears as durable as stone. Neither the machine or material is expensive, and should further trial show it to be as good as it appears, it will doubtless be largely introduced.

Open Ditches.—While there are many disadvantages connected with open ditches, and the farmer is fortunate whose land is in such shape that he can do without them, it is often necessary that they should be made to give an outlet for tile drains. The large seed farms of D. M. Ferry & Co., near Detroit, Michigan, are all drained into an open ditch which is located along the avenue. This gave a sufficient fall to thoroughly drain several hundred acres of land which could not have been drained otherwise.

When it is necessary to have an open ditch it should be properly made or it will fail to answer the purpose for which it is intended and will become a nursery of weeds and briers, seeding the farm and greatly disfiguring it. A ditch three feet deep should be not less than twelve feet wide at the top with the sides properly graded, and the earth taken out should not be left

in a ridge along the side of the ditch, but should be spread evenly over the adjoining land. The sloping sides should be sown in grass and mowed; and if weeds or sprouts grow in the



AN OPEN DITCH.

bottom of the ditch they should be cut and burned. An open ditch can be con-

structed and managed in this way so as to give an outlet for the water from the tile and with comparatively little waste of land. Much of the work can be done with the plow and scraper. Where an open ditch is badly constructed, made too narrow, with steep sides, and the earth thrown out left in piles, it can not give good satisfaction, or be kept clean with any reasonable amount of labor. Open drains will not prove satisfactory as a substitute for tile drains, but only in connection with them, and should never be resorted to where they can be avoided. They are expensive to construct; wasteful of land; and will require considerable labor each year to keep in good condition. They will also be impassable for the teams unless bridged, and must often angle through the fields.

Wherever a tile drain can be put in without having an open ditch through the farm, it should always be done.

The requisites of a good tile drain are:

1st. Good durable tile of sufficient size.

2d. A free outlet.

3d. The grade must be regular.

Depth and Distance Apart of Drains.—No general rule can be given as to the depth at which tile should be laid, as this must to some extent be governed by the character of the soil and lay of the land. On Eastview Farm we strike limestone in many places at a depth of two feet or less, and have never been able to lay tile deeper than two feet, and these drains have given good satisfaction. Where there is fall enough and a good outlet, and the soil is such as to admit of spading, I would recommend three feet, as the extra cost of the deeper

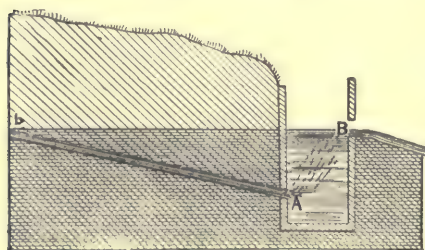
digging would be more than balanced by the fact that the drains could be put farther apart. I should not be deterred from draining, however, even though the stone came so near the surface that I could only lay the tile twenty inches deep. I have tiles laid at this depth that have done good service for twenty years and have never given me any trouble.

As to the distance apart, I am inclined to think that the usual directions call for more drains than are necessary. Waring in his book on drainage recommends "that drains four feet deep be laid from forty to fifty feet apart and on retentive clays even as close as eighteen feet, and that there are few soils which need draining at all on which it will be safe to place four foot drains at much wider intervals than forty feet." Professor Mapes says "three-foot drains should be placed twenty feet apart, and for each foot added to the depth the distance may be doubled."

Mr. Billingsly in his recent work on drainage says: "In our experience, drains placed one hundred feet apart on loamy soils and three and a half feet deep, will thoroughly drain the soil. If, however, the soil is very retentive, especially near the surface, a distance of fifty to seventy-five feet may be required to give thorough drainage." So far as my own experience goes I should agree with Mr. Billingsly rather than the other authors quoted. I have on my own farm had the fact demonstrated that a drain but two feet deep will affect the land to a greater distance than is commonly supposed. The subsoil on my farm is a stiff, yellow clay, and in my earlier draining I laid my laterals two rods apart, as I could only place them two feet deep. Near the head of my drains which flow south-east, we reach a level, and in a few rods the land falls to the north-west, and here I have another line of tile running to the north-west, the head of it being twenty rods from the head of the drain flowing in the opposite direction. Immediately north of the line of drain which flows south-east, and east of the head of the drain which flows to the north-west, is an acre of land belonging to a neighbor and which is about eight inches lower than my land south and west of it. Before I put in these drains this land

was flooded every winter and often till late in the spring, but these drains have relieved it of water so that now it grows good crops and can be plowed as early in the spring as the remainder of the field, which is rolling, with good natural surface drainage. My nearest line of tile is about forty feet from the edge of it, and considerably more than one hundred from the center of it. There are two more laterals parallel with the one mentioned and thirty-three and sixty-six feet farther away from the line between me and my neighbor, as I put in three parallel lines running to the main ditch. These drains, although laid much shallower than is usually recommended, have removed the surplus water from a strip fully double the distance that most of our writers recommend. In my own judgment the cases are rare where it would be necessary to lay the laterals nearer than one hundred feet.

The Outlet.—The first consideration in drainage is the outlet. The English call it the “outfall,” which name is very appropriate as there must be a fall to carry away the water and keep the mouth clear or the drain will not long continue to do good work. More drains are ruined from lack of a good outlet at the start or from neglect to properly finish the mouth of the ditch than from all other causes combined. Whatever the expense, necessary drains must be opened and a way pro-



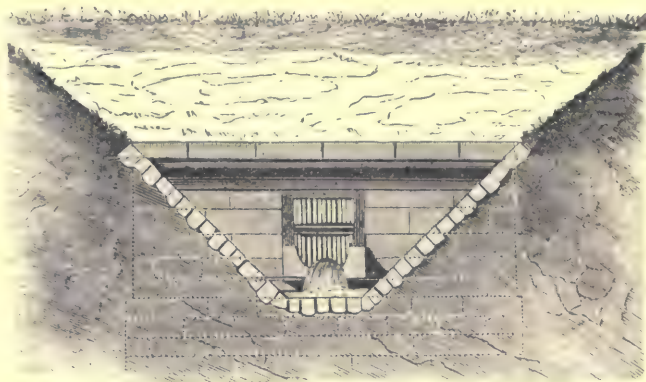
A FAULTY OUTLET.

vided for the water to flow from the mouth of the tile with perfect freedom, or the drain will fail to give satisfaction and will be in danger of becoming worthless. I have often seen drains so located that an outlay of from three to

five dollars would have opened a clear way for the water to escape, but instead of doing this, a barrel or box had been sunk, and so arranged that the water had to rise a foot or more above the tile and then flow off. Now if the fall were six inches to the hundred feet, this would back the water two hundred feet up the tile, not only raising the water line to a level with the

top of the barrel but also making it certain that sediment would be deposited. Our cut on page 66 shows a faulty outlet with the line of saturation in the soil extending back up the line of drain.

The outlet of every drain should be protected from stock and also from vermin. The best way is to build a good wall of stone, which should extend



A GOOD OUTLET.

down so as to have a firm foundation, and an iron grate should be built in so as to protect the mouth of the tile from the entrance of rabbits, muskrats, etc.

Laying Out the Drains.—Having selected the outlet, which will usually be indicated by the natural course of the surface water, you should lay out your drains before beginning the work of digging. Each field will need a different arrangement of drains, suited to the lay of the land. In one field a single main will answer, with laterals extending on either side and the size of the tile in the main may decrease as you approach the head. In another field two or more mains may be necessary which can all be brought to the same outlet, or such mains may enter the principal main some distance above its mouth. The straighter we can lay off our drains, the better, because there will be less friction when the water flows straight, and a straight line being the shortest distance between two points, it will take less tile; and if in mapping the drain the points of angles are established, by stretching a line the exact line of the drain can at once be determined, if it is necessary to open it for examination.

Most works on drainage give elaborate directions for leveling, and cuts of various instruments to be used for the purpose.

I agree with Mr. W. I. Chamberlain, one of our best modern writers on drainage, when he says: "The soil water is the poor man's theodolite and level." As previously stated, if the fall is slight, or there are unusual difficulties to overcome, I would secure the services of a competent engineer; but otherwise I would lay out the drains according to the slope of the land, and dig them when the water would follow, and level by it. If the water will flow after the first spade of earth is removed, it will be easier to establish the grade at this point than at the bottom of the ditch. It is wise to begin the work at a time when there is enough water in the soil to flow through the drain, as this will not only enable you to get the grade right, but the ground will spade much easier than when dry and hard.

Silt-Basins.—Where the lay of the land is such that sub-mains must join the main drain, a silt-basin should be located to receive them. It may be described as a small well, and may be

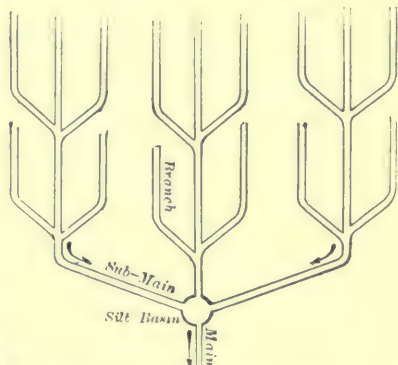


A SILT-BASIN.

made of stone, brick, or wood. It may be of such size as suits, but should always be at least one foot deeper than the bottom of the drain; and the top of the tile at the outlet should not be higher than the bottom of those through which the water flows into it. This will enable us to unite several drains entering at different angles without the objectionable feature of short turns. It also permits the settling of any sediment that may find its way into the tile, where it can be easily removed. The basin should be thoroughly made, and have a tight-fitting cover. This silt-basin, if properly made

and protected, can be used as a well, and will furnish good drinking water for men and horses whenever the drains are flowing. It is best to construct these basins at points where the grade suddenly changes from a steep to a less one. Whether silt-basins will be needed at all, or how many of them, will be

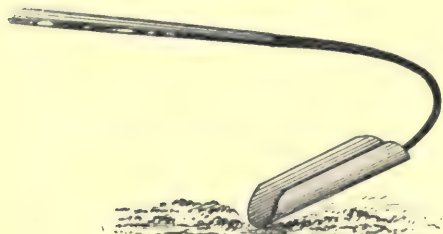
determined by the nature of the soil and number of branches to the drain. In a firm clay soil there may be little or no deposits of silt after the drain has been in operation for a short time; but in sandy soils, or those streaked with sand, quite an amount of silt will find its way into the tile for some time. I would always advise their use where, as shown in the cut, several drains must be brought together.



SEVERAL DRAINS UNITED AT A SILT-BASIN.

Digging the Ditch.—The tools necessary to do good work are: First—A ditching-spade for the first spading; this has a blade eighteen inches long, a little narrower than the common spade, and slightly curved, so as to enable it to hold the earth and lift it out. Second—A tile-spade, which is narrower than the ditching-spade, and tapers towards the point. Third—A pull-scoop, or tile-hoe, for cleaning the bottom of the ditch. These spades are familiar to our readers, and are kept on sale by most hardware dealers; but, as the tile-hoe is not so common, we give a cut of it below.

The narrower the ditch can be dug the less weight of earth must be handled. The sides should be cut smooth, and slanting to the bottom, which should only be dug wide enough to receive the tile. In good soil, which can be spaded, a ditch need not be over ten or twelve inches wide at the top. If the land is so hard that a pick must be used, it may be necessary to have the ditch much wider at the top, but it should always slant to the width of the tile at the bottom.



A TILE-HOE OR PULL-SCOOP.

It is best to lay the tile by hand, although, if the bottom is soft, it can be done from the surface with a tile-hook; but,

if the bottom is firm and hard, the workman may stand on the tile

already laid, first covering them with moist clay to the depth of six inches, and pressing it firmly about them. This clay can be sliced from the sides of the ditch with a spade. Great pains should be taken in laying the tile to see that they fit exactly, as the current will be greatly impeded and the danger of obstruction increased if there are inequalities in the line. There is no danger whatever of laying them so close that the water can not enter.

With a good team and plow the first ten inches of the drain can be dug more expeditiously and with less labor by plowing; and in filling the ditch after the first six inches of earth is put on, the horse can often be used to advantage, either to turn the soil in with the bar plow or to loosen it with the cultivator, so that it will shovel easily. All the earth should be piled on the drain, as it will be needed when it settles. If the drain is in low land where the water is likely to gather during a heavy rain, a channel must be cut for it at one side, if possible, until the earth has settled, or there will be danger of the tile being washed out. All these necessary precautions should be attended to at once, as if neglected then, they are often never done and the entire work may be endangered. The upper end of the last tile should always be closed with a flat stone or brick before filling. In a clay soil no covering of the joints will be necessary, but in sandy, as other loose land, it may be needed, and nothing better can be had for the purpose than pieces of sod cut from a stiff clay soil, but fine hay will answer.

Spouty places are sometimes encountered where the bottom of the drain is so yielding that the tile can not be laid evenly. In such places a fence board can be placed in the bottom, or if good gravel can be had, enough of it can be placed in the drain to give a solid foundation. It is best to deaden or remove all trees from the line of the drain, and willows are especially dangerous. Experience has shown that it is not safe to have a willow tree within seventy-five feet. If these trees are left near the drain they will often in two years entirely fill it with fibrous roots. The elm is nearly as bad as the willow. If the drain has been properly constructed and all trees removed, the

only care it will need will be to keep the outlet free and attend to emptying the silt basins.

Cost of Drainage.—The cost of drainage prevents many farmers from undertaking it at all, but as it will often add to the permanent profits from the land, and greatly increase its value, the farmer should look upon it as an investment of capital, and often it will prove the best investment he can make. Doubtless there are many farms whose productive capacity might be increased fifty per cent by one-fourth the outlay that the purchase of one-half more land would cost, and no extra fences or taxes would be called for, or extra teams to work it required, as in the other case.

The entire cost of drainage is often repaid by one or two crops. Professor Townshend, in a lecture on drainage, at the State University of Ohio, made the following statement: "I once underdrained a part of a field at a cost of \$22.50 per acre, and seeded it to wheat, and at harvest it yielded twenty bushels to the acre more than the part of the field not drained. I sold the wheat for \$1.25 per bushel, and the extra yield paid all the expense of draining, and left me a little in pocket." A friend, T. B. Barkley, living a few miles from me, in the flat lands of Franklin County, Indiana, in response to my request that he should give me his experience in draining, writes me as follows: "When I took possession of my farm I found a twelve-acre field which my neighbors pronounced barren. They told me that ten bushels of wheat to the acre was the largest crop it had ever grown, and it required a good season to give that, and they advised me to use it for pasture. I determined to drain it, and laid two mains, with five and six inch tile, and five laterals with four inch. My first wheat crop after draining gave me an average of thirty-five bushels to the acre, and at one dollar per bushel, the extra yield of wheat paid double what the draining cost."

The cost of draining will vary somewhat in different localities, but less than three feet deep, in ordinary soil the digging and laying of the tile should not cost above twenty-five cents per rod; the filling can be done for five cents per rod, and when

you add the cost of tile, you will know the cost per rod of the work. Mr. Billingsley estimates the cost per acre, with the laterals, from sixty to one hundred feet apart, at from fifteen to twenty dollars, and a field may often be sufficiently drained at a much less expense.

There are localities where there is, at a depth which can be reached, a strata of gravel, and by digging till this is reached the surface water will sink. This is called perpendicular drainage.

Surface drainage should receive attention on all farms, whether underdrained or not. Heavy crops of wheat are often grown on flat land by plowing in narrow lands and opening the dead furrows so that the water can escape. More or less wheat is winter-killed annually because the water is allowed to stand on it. Hilly pastures are gullied and ruined also for the want of a little care in dividing the water so that it will pass off in several small streams, instead of allowing it to gather in the low places and form a torrent. Every thing connected with the removal of the surplus water from the farm calls for prompt and intelligent action.

CHAPTER IV.

MANURES.

THAT the majority of farmers need to be educated on the subject of making, saving, and applying manure requires no argument. Look about you in almost any locality, see how small an amount of the land is manured at all, how little intelligence is shown in handling and applying the manure used, how universal the waste of manure, and how large an area is cultivated which does not pay the farmer even fair wages for his labor, and you will agree with me that the work of fertilizing the farm must begin with the education of the farmer.

In writing on this subject I shall not attempt to be scientific, but treat it from the stand-point of the practical farmer. In another chapter you will find the chemical constituents of plants and manures given, and I recommend a careful study of that chapter, for the intelligent farmer should not be willing to live in entire ignorance of a science in which he is so deeply interested.

To farm profitably we must maintain the fertility of the soil, and in many cases restore fertility to soils that have been impoverished by bad management. This necessitates care, economy, and intelligence in saving and applying all the manurial substances at our command. The practical fact meets us that without manure and rotation, our fields produce less from year to year, until they reach a point—and many of them have already reached it—when they will yield no profit. It is our custom to speak of such soils as exhausted; it would be nearer the truth to say that their available plant food was exhausted. When we apply manure to the soil, we do more than furnish it with the amount of potash, nitrogen, phosphoric acid, etc., con-

tained in the manure we apply, for we start a chemical action by which compounds are formed in the soil, and fertilizing substances which are inert and unavailable, are unlocked and brought within reach of plants. In enriching the farm we should exhaust home resources before attempting to buy manures. There are thousands of farmers buying manures from the village and drawing it to their farms at heavy expense, or buying commercial manures, who have never yet half utilized the sources of plant food on their own farms.

How shall we get the most manure on the farm? Not by the system generally practiced, for I think that, on a majority of the farms I have seen, the amount lost is much greater than that which is saved. On many farms the wheat is thrashed in the fields or wood lot, where the straw is left—often for years—to slowly decay. The corn is husked in the fields from the standing stalk, and through the winter the cattle roam over the farm and get a precarious living from the stalk pastures. The manure from the horse stables is thrown out of a window and accumulates in a pile, where it heats and burns out its nitrogen, and is then leached of its more valuable soluble constituents, until it possesses but little value. The hogs are penned for fattening, on some stony knoll or ravine, for the very reason that the rains will wash away their dung and leave them a clean place to feed. This picture of mismanagement is not overdrawn, and that must be a rare neighborhood where one could ride even an hour or two without seeing it verified in a greater or less degree.

One reason why farmers are not more careful to save manure is, I think, that they apply what they do save in such a condition, and on such soil and in such a way, as to get but little good from it. It would probably astonish a farmer who is drawing out a dripping load of half-rotted straw—called, by courtesy, manure—if he could see how much, or, rather, how little, actual plant food his load contained. A ton of average farm-yard manure contains nearly three-fourths of its weight of water, and but twenty-three pounds of valuable plant food, the remainder being made up of sand, lime, carbonaceous matter, etc.; and, if this is true of average manure, we can largely discount the value

of half-rotted straw or manure that has been injured by heating or leaching. Then the farmer, instead of applying this manure to a crop which will of itself produce something to enrich the soil, draws it out to some poor spot in the field, where he intends to plant corn, hoping in this way to bring that spot up to average fertility with the rest of the field. Instead of putting it near the surface to warm the soil and be acted upon by the atmosphere, he plows it under as deeply as possible. He sees but little effect from it, and is glad that he has no more of it to handle. Coming back to the question :

How Shall We Save the Most Manure?—First—We must have a good barn-yard, but this I shall describe in another chapter. The cattle should, when not in the stable, be confined in the barn-yard from the time they leave the pasture in the fall till turned out in the spring. To this barn-yard should be brought all the waste of the farm. Stack the straw here; bring the corn-fodder from the fields; carry the waste from the mangers, and wheel the manure from the stables, and spread it so that it will be mixed and incorporated with the waste material. Every thing in the way of vegetable refuse that will absorb liquids should be brought here—potato-tops, cornstalks, straw, sorgo bagasse or sawdust from the mill. The farmer who has followed the old plan of stacking straw in the fields and pasturing his cornstalks, will be astonished at the bulk of material he can get together in a winter in this way. If the hogs can be kept in pens adjoining the barn-yard, so as to be bedded with some of the waste, and let out a part of each day, they will add to the value of the manure. In the stable there should be tight floors, and enough sawdust or other absorbents used to save all the liquid manure, for this from horses, cattle, or sheep is of much greater value than the solid. To save the liquid manure in the cow-stable there should be a water-tight manure ditch, and this will be illustrated and described in another chapter.

The farmer should guard against the sources of waste in manure, and the greatest causes of waste I conceive to be, first, from leaching; second, loss of ammonia from excessive heating; third, unwisely applying the manure to the soil. To guard

against the first it is necessary to see that nothing leaches from the manure-pile, or, at least, if it does, that it is put back. A manure-heap may be arranged so that there will be drainage from it into a tank, or, if on a clay soil, to an excavation, so puddled that it will not leak, and this liquid dipped or pumped back upon the heap. The leaching which causes loss is where the barn-yard is so located that the water from the eaves of the barn, or from adjoining land, flows through it, carrying away the soluble portions of the manure. If the compost heap is kept in proper shape, and is of sufficient depth, the rainfall will not be likely to leach it, and will be an advantage.

The shape of a manure-heap has much to do with its condition. If thrown up loose, in a conical heap, fermentation will be so excessive as to cause a large loss of ammonia. The remedy for this is to make the heap flat; and, whenever you wish to check fermentation, tramp it down solid. By this means you can regulate the degree of fermentation perfectly.

If any one doubts this, let him try the following experiment: Draw out a cord of good horse-manure, and fork it out of the wagon into a pile six feet high, built up, with a regular slope, to a point at the top. In about twenty-four hours you will find a violent fermentation, the heap will smoke like a chimney, and there will be a pungent smell of ammonia, which will extend, perhaps, a quarter of a mile, and last for several days. After the fermentation has subsided, if you examine the pile you will find all the upper part of it dry and fire-fanged. If you attempt to fork it, you will find it in dry flakes, which will adhere to the fork-tines, and it will be in such a condition that it will be impossible to spread it evenly. If, at the same time, you put a cord of the same manure beside this, but build it in a flat pile, three or four feet high, with perpendicular sides, and tramped down as solid as you can, there will be very little escape of ammonia, but a mild fermentation will go on, and when you open the pile you will find it fine and moist, and in the best possible condition for application to the soil.

With a little care and intelligence the farmer can guard against loss from either leaching or evaporation, but carelessness

in these matters may result in the loss of more than half the value of his manure.

The third cause of loss which I mentioned—want of intelligence in its use—is, perhaps, greater than is generally suspected. Manure is so valuable that we must apply it, first, to such crops as will give an immediate profit; and, second, as far as possible with reference to its growing at the same time a crop which shall furnish plant food in the soil. Many farmers use the bulk of their manure on corn land. While this is undoubtedly profitable in the East, where corn brings a high price, and the fodder will go far towards paying the expense of growing the crop, I think that, west of the Alleghany Mountains, where we must come in competition with the great prairie corn-fields, we can not afford to use manure, direct, for corn-growing. I have long since settled this question in my own practice, and have not for years applied a load of manure, directly, to the corn crop, and should feel that I was not getting half its value if I did.

I use all the manure I can spare from the garden and potato-patch on my wheat. By so doing I rarely fail to get well paid for my manure from the wheat crop, and at the same time it grows a clover crop, which is worth more to fertilize the corn crop which will follow than the manure would be if applied directly to the corn. By this plan we can make our manure do double duty, grow a paying crop of grain, and at the same time a clover crop, which, even if all utilized for hay or pasture, will fill the soil with roots, change its chemical and mechanical condition, and, by its dense shade, keep the surface cool and moist, so as to cause the weeds to come up, and then smother them; so that we have a field for corn cleaner, richer, and mellowed than if we had made a direct application of manure.

There are some other incidental advantages in using manure on the wheat crop. It gives us more time to get it in good condition. We keep—or at least ought to—our stock in the barn-yard till after our corn land is plowed, and are adding straw, corn-stalks and other litter each day. I do not want to begin forking up the manure till after the stock goes to pasture, for it will make the yard dirty and uncomfortable for them. Again, in

early spring the manure usually contains a much larger amount of water, making it more laborious to handle and heavy to draw, and the fields are soft, so that the wagon draws heavily and at the same time the land is damaged. I think that I can reduce the labor of drawing out the manure one-half by proper handling and leaving it to be taken out in August, and this saving will pay for all the work of handling.

My plan of management is this: If we find in April that the cattle are not likely to reduce the straw stack, we help them by cutting down or pitching off from the top, or if we need it, we draw the remainder of the stack to the barn. Our barn-yard is now covered with a coating from one to three feet deep, composed of the droppings of the cattle and the manure from the stable, mixed with the straw and corn stalks, and all tramped down solid. The first heavy rain that comes after corn-planting which makes the land too wet to work and thoroughly soaks the contents of the barn-yard, we put all hands at work turning it over. We take pains to shake it up well and to see that there are no dry spots, and throw it up in ridges four or five feet high, drawing them in at the top so as to favor fermentation. We make these ridges parallel, so that at a second turning we can get two of them together into a bed. If we find fermentation becoming too rapid at any time, we level the tops of the piles and tramp them, or what is easier done, let our hogs into the barn-yard and feed them on the tops of the piles a few times. Any time within a month when we have another rain to stop field work, we turn the manure again, taking great pains to fine it as much as we can and to get it into as large beds as possible. This time we leave it flat on top and think it a great advantage to dip some strong manure water over it. If we expect to thrash early, we at this time try and make room for stacking the straw from the new crop, and sometimes to do this we must draw out a part of our manure and pile it convenient to where it will be needed. We have generally turned our manure but twice, but I am so thoroughly convinced of the value of fine manure that I intend giving it an extra handling in the future. "What! handle your manure three times before hauling out?" Yes, and at a

profit, for I shall not only save much labor when I do draw it to the fields, but I shall have the manure in a condition to go further, and to be at once available to the crop. My experience teaches that a small amount of manure in good condition, applied at the right time and place, is worth more than three times as much in bad condition and unwisely applied.

Every experiment which I have ever made in this line has confirmed me more and more in the belief that to get the best results from manure it must be pulverized. In the fall of 1882 I sowed a number of experimental plots of wheat. Each plot contained exactly four square rods or one-fortieth of an acre, and as I could not well drill so small an amount, I sowed broadcast. Adjoining plots were sown at the same time and with the same amount of seed per acre. One had no manure and on the other I scattered just four bushels of fine manure—one bushel to the square rod or at the rate of four moderate loads per acre. The unmanured plot was entirely killed by the severe winter that followed, while the manured plot came through in fair condition.

The value of pulverization in making fertilizers promptly available may be illustrated thus: Two hundred pounds of finely ground bones, applied to an acre, will often make an increase that year of a ton of hay or ten bushels of wheat, while a ton of whole bones would have no visible effect, though containing ten times the amount of plant food. Our State Boards of Agriculture appreciate so highly the influence of pulverization in rendering plant food in manures available, that they have adopted a higher rate of valuation for phosphate contained in finely ground bones than for that in bones ground coarsely. I think this particularly true when we use manure on the wheat crop.

The period of growth in autumn being short, it is important that the plant shall make sufficient growth to cover the ground, furnish protection to the roots for the winter, get well rooted so as to be ready to make a vigorous start in the spring and also be able to resist the enemies that seek to destroy it. A little manure, finely pulverized and thoroughly incorporated with the soil at the surface, will do this, and for many years I have therefore used the manure for a wheat crop as a top dressing. An-

other reason why I prefer to keep the manure at the surface is that we wish it to help the grass or clover, and if plowed under deeply it will not be immediately available for them.

There are two other points in the influence which manure has upon plants worthy of notice; one that it causes early maturity, the other that it enables the plant to resist enemies. The first of these is of especial importance to the market gardener, as a difference of two or three days in getting a crop into market will often change the profits materially. I remember planting an acre in sweet potatoes in 1862 and had only manure sufficient for half the plot. The manured part was marketed in August and early September, and yielded one bushel to the square rod, and sold for one dollar and sixty cents per bushel. The unmanured part came into market later, when the price was but one dollar per bushel, and yielded but one bushel of merchantable tubers to four square rods. The first half acre was very profitable, the last paid but little more than the expense of growing and marketing.

Every farmer has noticed how a little manure enables a wheat crop to resist enemies. The manured land in the wheat field makes a good crop, though the remainder may be eaten up by the fly or chinch-bug, frozen out by the winter, or shrunk by rust.

Still another advantage from the use of manure is that it improves the quality of the product. This is more noticeable with some crops than with others. I have, in experimenting with potatoes, manured alternate rows and found the manured rows to be nearly all merchantable, while the unmanured rows would have from twenty-five to forty per cent of small, unsalable tubers.

Next to applying manure to the wheat crop, I think the best use we can make of it is on grass land; for this purpose it may be taken out and spread in winter while the ground is frozen, and this I think is the best time to apply it to this crop. It should be spread evenly from the wagon, for if dropped in piles it would kill out the grass. When the manure is applied to pasture land some coarse litter with it will not be objectionable as it will protect the grass and make it start earlier in the spring, but when applied to meadows it should be well rotted.

There is little difficulty in reducing coarse manure even in winter if there is enough horse dung in it to cause active fermentation, for "it is always summer in a manure heap." There are many farmers who think a straw stack, or corn butts, can not be reduced to a condition in which it can be used for top dressing, in less than a year, and I have often received letters asking if it could be done and how. When I followed truck farming I wanted most of my manure for spring use, and I have fed out twenty acres of heavy corn fodder, cut up at the ground, thrown all the butts into the manure pile, and had it in good condition for the garden before the first of April.

The way I managed it was this: My barn-yard was small, about forty by fifty feet, and we took pains to see that all the material was well mixed; I do not mean that we mixed it by forking over, but merely that we did not dump the horse manure in one part of the yard and the cow manure in another, and throw the corn butts in a pile by themselves, but we took pains to see that the wheelbarrow loads of manure from the horse and cow stable were placed so that they would be sure to become mixed, and instead of throwing an armful of corn stalks down in a pile we scattered them singly. About six weeks before we wanted to use this manure we put a few good-sized, vigorous hogs in the barn-yard and fed them on the manure pile. They would work it over every day to the depth of a foot or more, and in about two weeks the stalks were pretty well broken up and the manure ready to turn. Then we began at one side and turned it from the bottom, mixing thoroughly, and in three weeks it was ready for use.

Bommer's Method.—Some forty years ago a process of rapidly reducing crude vegetable material to manure was patented by George Bommer, and in 1847 the right for the United States was bought by Eli Barnett, of Connecticut. I think the method was never adopted, at least not to any great extent, but it contained some valuable ideas, which in a modified form could be used to good advantage by farmers to-day.

The method briefly stated is this: An excavation is made—on a hard soil that will not leach—to the depth of eight to

twelve inches. This is made dishing, and with a slight fall, so that any liquid will drain into a vat; or it may simply be a pond, if in a stiff clay. Strong poles are laid across the excavation, on which an open floor of rails or old boards is laid. On this floor is built up the material to be made into manure, which may be straw, weeds, corn-stalks, sods, sawdust, spent tan, apple pomace, peat, swamp mud, or any or all of them mixed. The pond or vat is to be filled with water, which is to be made into what is called saturated or corrupted water. This is done by throwing into it dead animals, butchers' offal, chamber and kitchen refuse, hen manure, etc. It is claimed that the addition of a pint of quicklime—previously slaked—to each barrel of water will prevent any unhealthy exhalations from this pond. After this water has become polluted it is to be made into a lye by adding to each thirty barrels the following:

- 2 bushels of quicklime.
- 2 bushels of chimney soot (if obtainable).
- 2 bushels of wood ashes.
- 4 pounds of salt.
- 2 pounds of saltpeter.
- 5 bushels of plaster paris.
- 3 barrels of night soil.
- 1 barrel of water leached from manure.

This lye is then to be dipped or pumped over the mass of absorbents which have been built on the floor over the excavation and will produce a violent fermentation, killing all seeds and causing rapid decomposition. The liquid should be applied until it leaches through, and care should be taken to apply it to all parts. After it has heated up thoroughly, give it a second watering, and a few days later still a third. The manure will be ready for use in from fifteen to twenty-five days.

I have described this method, not because I suppose that our readers will be likely to adopt it, but because it suggests the best use to be made of our liquid manures. I believe it would pay to have a vat adjoining every barn-yard to conduct the liquid manure into, and that the best way to use this liquid would be to saturate the manure heap with it. On our clay upland there is no difficulty in making a pond water-tight, and all we should need to guard against would be its overflowing

from the surface water. A pile of coarse manure wet with this lye would be improved in quality, and it would greatly hasten its decomposition and aid in pulverizing it.

Special Fertilizers.—I find that we can save in a year a large amount of valuable fertilizers. Our plan is this: I have a shed sixteen feet by eight set apart for this purpose; during the fall we store here two or three wagon loads of the richest and finest soil we can get. I sometimes get it from the woods, sometimes from an old chip-yard, and again from under an old building. We put with it some sods. On this heap we pour our chamber slops, and once a month, or oftener, we clean the box under the privy, and the floor under the hen-roost, and take this material to the shed; we mix this at one end of the shed with an equal bulk of the earth and sprinkle a little plaster over it, and by spring we have accumulated quite a bulk. We now cut it down with the spade, mix it thoroughly, and work it over till it can be screened, and then pass it through a mason's sieve. The coarse part is wheeled to the compost heap, and the fine spread out to dry. This makes a fine and good manure for using in the hill or for top dressing the radishes, onions, etc., in the garden, or it can be sown with the fertilizer drill on the wheat crop. I think such a fertilizer, when carefully prepared, is worth at least ten dollars per ton. I have had as good results from pulverized hen manure, drilled at the rate of two barrels to the acre, as from two hundred pounds of bone meal. There is nothing disagreeable about preparing this compost, except cleaning the privy box, for if laid up in alternate layers of earth, and sprinkled with a small amount of plaster, the mixture is odorless.

A single experiment which I have made with bran as a manure, will, perhaps, be read with interest, and lead others to experiment further. I mixed one hundred pounds of bran with an equal bulk of rich mold, and wet it with leachings from the manure pile. It underwent a violent fermentation, and I then spread it out on the barn floor and turned it every day till it cooled off, and was so thoroughly decomposed that no one could have told what it was. I planted in June on a poor clay knoll

some peach-blow potatoes, and manured every alternate row with a handful to the hill of this bran mixture, using at the rate of five hundred pounds of bran to the acre, which, at that time, cost me but ten dollars per ton. In a month there was a difference of six inches in height in favor of the rows fertilized with the bran, and they were a better color. At digging time I dug and weighed first from the manured, and then from the unmanured rows, and repeated this several times; in no case did I get less than fifty per cent more from the manured rows, and in several cases double, and the quality was very superior. I estimated that the extra potatoes produced by the bran did not cost more than eight cents per bushel. A friend of mine the same year tried dry bran in the hill for his potatoes, and the result was that scarcely any of them came up, either the fermentation killed the sprouts or the dry bran absorbed the moisture from the seed so that it could not grow.

In another chapter you will find tables giving the relative values of manure from different kinds of stock, and also the amount and value of the manurial constituents found in one ton of different foods, and I recommend a careful study of these tables. I think that but few of our farmers give sufficient weight to the fact that manure contains only what we put into it, and that a ton of manure made by a fat animal, fed on grain, bran, and oil meal is worth several tons from a poor animal fed on straw or poor hay. By recording the experiment with bran as a manure, I do not wish to be understood as recommending its general use, for under ordinary circumstances it would not, perhaps, be economical. The best way to use bran as a manure, is to feed our cattle liberally with it, and carefully save the droppings, both liquid and solid, for its value will be found nearly as great after passing through the animal as before.

You will find in the table referred to the manurial value of a ton of bran given at \$13.25, and I think that in preparing a special manure for use in the hill, or for drilling with the fertilizer drill, it may be much more than this. I find it especially valuable when I wish to produce a quick, active fermentation in order to thoroughly mix and pulverize some special manure,

such as night soil, or poultry manure which has been wet so as to have lost its heating power. When it can be bought at low prices I would recommend that experiments be made with it as a fertilizer.

I think if bone meal is to be applied broad-cast, it would pay to mix it with an equal bulk of bran, and wet it with lye from the manure heap, and as soon as it is thoroughly hot mix again with an equal bulk of rich sifted mold, with a sprinkle of plaster, and turn it every day till cool. I recommend this for the reason that I think the fermentation produced by the bran would partly decompose the bone and make it immediately available to the wheat plant, which, as the season of growth in the fall is short, is a matter of great importance. My experience with bone meal on the wheat crop has been that I could see no effect from it until the following spring, and if only the bran in the mixture was immediately available, it would be a decided advantage, but if in addition the fermentation rendered a portion of the plant food in the bone meal at once available to the plant, it would be a still greater advantage.

Commercial Manures.—Under this head we include ground bone, super-phosphate, guano, poudrette, dried blood, rock-phosphate, plaster, and many other substances which are sold in the market as fertilizers. While their use is general in many parts of the East and South, it is but recently that they have been introduced in the Mississippi Valley, and there is much misapprehension among farmers in regard to them. Many regard them as stimulants only, which, while they will enable the farmer to reap larger crops for a while, will result in the final exhaustion of the soil. Others look upon them as a substitute for stable manure, and think that by their use they can escape much of the dirty, disagreeable work of handling barn-yard manure. Both these ideas are incorrect. Most commercial fertilizers furnish plant food, and cause an increase of crops in the same way that stable manure does, the difference being that they do not, like stable manure, furnish all the constituents of the plant, and so by the continued and exclusive use of a fertilizer that is deficient in some elements of plant food, heavy

crops may be grown, which will ultimately exhaust the soil of the elements wanting in the fertilizer. The remedy is to change the fertilizer, or use it in connection with stable manures.

These manures are not a substitute for stable manure, but should be used to supplement it, and the farmer should carefully save and apply every manurial substance produced on the farm before he invests in commercial manures. I would not advise any one to invest largely in any commercial fertilizers till by careful experiment on his own farm he has tested their value, for they are not uniform and certain in their effect like barn-yard manure. It is wise, therefore, for all farmers, even though they do not now need them, to experiment each year with small amounts of commercial fertilizers of different kinds, so that if at some future time they should wish to use them, they will be able to make an intelligent selection.

Three questions should be carefully considered in deciding whether or not to invest in any commercial fertilizer. First. Is it what your soil needs? Second. Is it adapted to the crop to which you wish to apply it? Third. Is it worth the price charged for it? This question of commercial fertilizers will be treated more fully in another chapter.

Green Manuring.—Under this head I include any and all crops that help to enrich the soil or improve it mechanically, whether grown especially for the purpose or utilized for other purposes, and the fertilizing merely incidental. I have already in this chapter intimated that, as far as possible, we should use our manure with reference to its producing, in addition to a grain crop, something that we can return to the soil. Probably the best manure we can have, especially for corn, is an old blue-grass sod; but it takes years to produce this, and we can not afford to depend on it. All things considered, clover should be placed at the head of the list of plants valuable for green manuring; and one reason why I give it this preference is, that the crop may be utilized for stock food, and yet excellent effects produced on the soil. This is largely due to the network of roots, which penetrate the soil far below the reach of the plow, and which constitute more than half the weight of the plant,

and contain more inorganic matter than the foliage. In my own experience, on land that had been cropped until it yielded no profit, I have found that plowing under the second growth of clover, after cutting the first for hay, has given me an increase of ten to fifteen bushels of wheat to the acre, and as good results as a dressing of ten or twelve loads of stable manure to the acre. Farmers of large experience in growing clover seed find that, even when the crop is cut twice (once for hay and then for seed), the land is greatly benefited, and careful experiment has shown that the greatest development of root comes after the first cutting, and while the plant is maturing the seed.

Harlan, in his book, *Farming with Green Manures*, not only recommends using the entire crop for manure, but that the clover from four acres be cut and spread on one acre, and left there to rot, and that this cutting and spreading be done two or three times through the season. It seems to me that this would be too expensive manuring, for the crop is generally worth from twelve to twenty dollars per acre, and, in exceptional seasons, even more than this, for food and seed, and the cost of manuring an acre by this plan would often exceed the value of the land. Besides, if the clover was fed to cattle, and the manure properly saved and applied, it would be worth almost as much to the land as if it was all left to rot on the field. Our farmers who have had the most experience with clover, find that they can improve their land by its use while utilizing the crop. Professor Brown, of Indianapolis, writes as follows:

“In the process of recuperating exhausted soils, clover has long held an important place. In this process it performs its good work by two distinct methods: First, it increases the organic matter in the soil to a greater extent than any other crop; second, it brings within the reach of other crops a large supply of mineral elements. In regard to the first of these statements, we observe the large leaf surface which it exposes to the air, and by which it absorbs carbonic acid that is subsequently converted into organic matter. From this is formed the large amount of root which is a special characteristic of the red clover.

“One who has never performed the experiment will be astonished if he will carefully dig up a plant of red clover so as to preserve all the roots. He will find them penetrating far below any depth reached by his plow, and spreading laterally, so as to fill a wide space of earth with a complete network of organic matter. More than half the weight of a red clover plant is under ground, and is seldom taken into the account when we calculate the manurial value of a full crop of clover turned under with the plow. By repeating this process every third year, preceding a wheat crop, even a soil badly exhausted in organic matter may, in a few years, be made rich in vegetable mold. To produce the best results with clover on an exhausted soil, it will be necessary to apply a liberal top-dressing of gypsum and bone-meal every spring. By this means the activity of the vegetable forces is greatly increased, and the amount of vegetable matter to be plowed in, both top and root, will be correspondingly large. The effect of this on stiff clay soils will be to render them more brittle and easily pulverized, and to increase their power to absorb moisture and gases from the air. These properties constitute the leading features in the physical conditions of a fertile soil; and a soil brought into this state will need only the proper mineral elements to give it a high fertility.”

It is evident from the next sentence that Prof. Brown understands practically not only the importance of a mellow soil, but also that the use of clover will produce this desirable condition :

“There is no more direct road to this desirable state than by green manuring with clover. Practical farmers, who are the best observers of facts, and who too seldom inquire into the causes which lie behind these, all concur in the maxim that the mellowest soil they cultivate is that which follows a heavy clover crop plowed in. All this, however, presupposes that the clay soil has been properly relieved of water by underdrainage. Without this no soil can be made permanently mellow.

“The influence of clover on the mineral elements of a soil is that in which its chief manurial value lies. Professor Way gives us an analysis of the clover plant in all its parts—root,

stem, leaves and flowers—taken at the period of growth when the flowers had begun to fade. In order to get the mineral elements he reduced the plant to ashes, one hundred parts of which showed:

Phosphoric acid,	. . . . .	5.82
Lime,	. . . . .	35.02
Potash,	. . . . .	18.44
Soda,	. . . . .	2.79
Sulphuric acid,	. . . . .	3.01
Earthy matter,	. . . . .	34.92
		<hr/>
		100.00

“The striking feature of this analysis is the large proportion of lime and potash. Now, while it is evident that the clover did not produce these alkalies, yet it was the instrument for collecting them and bringing them into easy reach of other crops, and placing them in an available form for their use. The clover sent its roots down into the subsoil, far beyond the reach of the plow, and gathered up these important minerals and incorporated them in its own structure; and this, being decomposed, leaves its elements in the surface soil, ready for the use of subsequent crops.”

Many farmers fail to benefit their soil by clovering, from the fact that they turn on it when too young and pasture it off too closely. The development of the roots in the soil must correspond with the growth of the foliage, and a clover pasture that is closely cropped through the entire season will have but little effect upon the soil. I think that clover should never be pastured till the blossoms begin to show, and that this will be found more profitable both for food and fertilizer than to turn on it earlier. In favorable seasons I have had clover grow to its full height the first fall, making a crop that would cut two tons of cured hay to the acre. If, instead of cutting this, it is allowed to remain and is turned under the following spring, it will give a large amount of fertilizing matter for a corn crop. I turned under clover crops of this age in the spring of 1882 and 1883 that were as heavy as any growth I ever turned down, and produced as good effects on the corn crop that followed.

I have seen wheat crops ruined from plowing under a heavy growth of clover late in the season and seeding on it before the land had time to settle. I think that it may be set down as a rule that when clover is used as a fertilizer for wheat, it is safest to cut and remove the clover crop if heavy, unless it can be plowed under at least six weeks before seeding. Whether the damage to the wheat crop comes from the fermentation of the mass of vegetable matter in the soil or from the fact that it does not allow the land to become settled, and the spaces fill with water which in freezing expands the soil and kills the wheat, or from both these causes, I can not say; but the fact remains that the wheat is killed, and we should avoid the cause. My observation of this has been confined to clay lands, but I should hesitate on any soil to turn under a heavy growth just before seeding. For more than twenty-five years I have made it a rule to sow clover with all small grain, and it has paid me, even when I have plowed the field again for wheat the same fall.

I think that next in value to clover for green manuring I would place rye. It is admirable for this purpose, because, first, it can be grown to its full development between other crops without losing the rent of the land; second, it is an exceedingly hardy plant, which will grow on poor land and is seldom injured by the winter; third, its length of straw produces a great body of vegetable matter and makes it easy to plow under (by the use of a chain or the patent weed hook we can put it so thoroughly below the soil as to plant and cultivate a crop without disturbing it); fourth, its early growth in the spring prepares it for turning under, so that it may be followed by almost any regular farm crop. In the latitude of southern Ohio, rye will usually have attained its growth by the middle of May. I usually grow a half acre or so of it each year, and cut it when in blossom to be used for bands for corn fodder, and my diary shows that I have cut it as early as May 19th, and rarely later than the 24th. When the crop is to be used as a fertilizer, it is ready to plow down a week or ten days sooner.

The late J. B. Root, of Rockford, Illinois, was an earnest ad-

vocate of rye as a fertilizer. His first experience of its value was by accident. Wishing to grow a few acres of melon seed one season, after all his own land was occupied, he rented a piece of land on which rye was growing and plowed it under. The season proved dry, and while his crop was almost a failure on his own land which had been liberally manured, he found that the land on which the rye had been plowed under was loose and moist through the entire season, and produced a good crop. For several years after, until his death, Mr. Root made use of rye on all land wanted for late crops, and each year added to his appreciation of its value. In 1875 he wrote "I can not say that it adds as much to the fertility of the soil as forty two-horse loads of manure, but I do say that in dry seasons it produces as great an increase of crop. It certainly pays to use it largely even on land well supplied with stable manure."

I would recommend, when rye is sown for the purpose of plowing under, that two bushels of seed be used to the acre, and if the land is poor I would use some fertilizer to give the rye a start. In my own experience I have found the effect of rye quite lasting in the soil, and it gave a larger increase of the corn crop the second year than the year it was plowed down. Taking into consideration all the advantages of this crop, its hardiness, the ease with which it can be put in, its adaptation to poor soils, and the short time in which it will produce a large amount of vegetable matter to turn under, I can recommend it most heartily as a green manure.

Buckwheat is another quick-growing crop and can be sown in July, when, as is sometimes the case, the farmer fails to get a stand of clover. Where the entire season's growth is to be devoted to enriching the land, rye could be plowed under early in May and buckwheat sown, and plowed under in July, and a second crop of buckwheat sown, which would be large enough to plow under before frost. Mr. Harlan tells of a crop of buckwheat which he grew, that in fifty-one days, (between July 14th and September 3d,) made a growth of twenty-seven tons to the acre. The advantages of this crop are its rapid growth, which

enables it to smother out all the weeds and produce in a very short time a large amount of vegetable matter to plow under, and also the fact that it is tender and succulent, and can be easily plowed under and will decay rapidly in the soil.

Another crop which, I think, would be found profitable for this purpose, is corn. I have seldom known it to be plowed under, but in the few experiments that have come to my notice the result was highly satisfactory. In 1878 a neighbor, finding that his clover had failed, plowed up a piece of wheat-stubble, and with the force feed wheat-drill sowed corn at the rate of three bushels to the acre. This was about the first of August, and before frost the corn had attained a height of several feet, and was showing the tassels. As soon as the frost killed it it was plowed under, and the next spring the entire field was planted to corn. The growth of corn on the part where this crop had been plowed under was so marked that it could be seen to a row.

I think it important, when green crops are plowed under early in the season, and we expect to seed with some other crop, that we should follow the plow at once with the roller or harrow, or both, so as to compact the soil and bring it in close contact with the green plants; but, when we plow under a green crop late in the fall, and leave the land for corn, this should be omitted, and the land left as loose and uneven as possible.

Every year of experience on the farm deepens my conviction that through green manuring will be found the cheapest and best method of both maintaining and restoring fertility, and that the wise farmer of the future will use his manure more with reference to what it will produce to feed the land than to its immediate returns in grain. With less land under cultivation, more stock kept to consume the grass, all the manure saved and intelligently applied, and the land kept always at work producing a crop to be returned to the soil, our farms will increase in productiveness, and we shall solve the problem of profitable farming.

CHAPTER V.

THE SOIL AND ITS IMPROVEMENT.*

THE soil, the air, and the sun are the sources of all earthly life. From the sun is obtained all energy or force; from the soil and air the means of subsistence. Vegetable life, which is the original supporter of all animal life, draws from these three sources. From the soil it obtains a small per cent of its substance; from the air a larger per cent of substance, and from the sun the power by which it is able to take up dead minerals and invisible gases and work them up into all the useful and beautiful forms of vegetable life. The sun pours down its rays of life-giving energy unasked and unhelped. The air brings daily to the plant unlimited supplies of food. It needs no help from man; he could not change it if he needed to; it is everywhere plentiful, everywhere alike in its supplies of material.

But the soil varies greatly. We have soils which seem to contain all the material for the sustenance of vegetable life in exhaustless abundance. We have soils which are either entirely destitute of these substances, or else hold them in forms and conditions which render them as unavailable as though in the original rock, and we have soils occupying every shade of difference between these.

The fertility of the soil is the measure of its capability for supporting vegetable life, and on this depends the prosperity, not of individuals alone, but of nations. The civilizations of Egypt, Greece, and Rome had been impossible but for the wonderful fertility of the soil they possessed. The remarkable progress which has been made in the United States during the first century of its existence has not been due merely to the

* Contributed by R. S. THOMPSON, Author of *Science in Farming*.

intelligence and enterprise of its inhabitants, but also to the fact that within its limits was soil of unsurpassed fertility.

Whenever the soil of a nation becomes so impoverished that it is no longer able to furnish food in abundance, the prosperity of that nation must vanish and its progress cease. There is, therefore, no subject of more vital interest to humanity than the methods by which the fertility of the soil can be maintained and increased. There is no subject which, to the farmer, should possess so deep an interest as the origin, character, and treatment of his soil. He needs to know what it contains, what the crop derives from it, how loss of fertility under continued cropping may be avoided, and how its fertility, when once impaired by bad management, can be restored.

Origin of Soil.—It is supposed that, when the earth was first created and had cooled from its original condition of a mass of fiery molten material, it was simply a great ball of rock. The surface was seamed and scarred, and wrinkled with the struggles it had passed through. Water covered the more depressed portions of the surface, forming oceans, while great mountains of barren rocks reared their heads far above the clouds. On this rocky waste the sun poured its rays, and the rains descended in torrents, wearing away the rock, grinding the fragments into sand, which was strewn over the more level portions.

Other influences worked upon the rock. The frosts of winter, acting on the water that penetrated the cracks and fissures, broke off fragments, that were ground to powder by other forces. In presence of sun and water and air, chemical forces worked, causing the rock to soften and melt away in the form of clay, and the water took this and spread it and mixed it with the sand.

Thus a soil began to be formed of sand and clay, containing many substances from the rock, but specially two that were to be of great importance in the future history of the world, phosphoric acid and potash. Over all this waste floated the atmosphere, formed then, as now, chiefly of two gases, nitrogen and oxygen. Through the upper regions of this atmosphere, at times, roared great thunder-storms, more fierce and wild than those we

know to-day. The lightning would cause a little of the elements of the air to unite, forming a substance called nitric acid, which the rains washed out and brought down to the slowly forming soil, thus adding the substance, nitrogen.

Low forms of vegetable life were placed upon the earth. Mosses and lichens clung to the rocks and corroded them, drawing from them material needed for their own life. When these died, the substances thus obtained were added to the soil. Higher forms of life were placed upon the soil, taking from it nitrogen, phosphoric acid, potash, and some other substances we need not mention here, and gathering from the air the substance, carbon, which we see so often in the form of charcoal. This exists in the air in the form of an invisible gas, but the plant can take it from the air and change it into a solid form. When these plants died and decayed they added this new substance, carbon, to the soil, and it began to assume a dark color.

This work went on through the years and ages, and very likely through thousands of ages, and the soil was constantly being increased in quantity by the destruction of the rocks, gaining from them potash, phosphoric acid, and other mineral elements of plant life, and gaining from the rains nitrogen, in the form of nitric acid. The growing plants took these from the soil, added the carbon from the air, worked it all up into forms of life, and, dying, returned to the soil all that had been taken from it, and the carbon from the air besides. This carbon, thus added to the soil, could not be taken up by the roots of plants, but it made a suitable bed for them to grow in, and formed a soil that could retain the warmth and moisture so needful to their growth, and which was porous, to admit the air, also needed. As the process of decay in the soil continued further, this carbon gradually united with the oxygen of the air, forming carbonic acid, to begin the great circuit over again. Thus excess of this substance in the soil was avoided, except in places where the soil was always soaked with water. In these places the carbon of the decaying plants could not unite with oxygen from the air, and it accumulated, forming beds of muck, or peat, composed principally of carbon.

Thus was formed the soil on which we live, and it contains three substances of great importance—of such importance that it will be well to repeat them: Phosphoric acid and potash, obtained from decaying rocks, and nitrogen, brought down by the rains from the air; also, a substance of scarcely less importance, carbon, gathered by the plants from the air, and added to the soil on the death of the plant. This work is still going on. The rocks still decay and furnish their share of plant food; the rains still bring down nitrogen, and the plants, when allowed to decay upon the land on which they are grown, still add carbon.

Source of Nitrogen in Soils.—We have seen that the original source of nitrogen in the soil was that brought down by the rains in the form of nitric acid. Of course decaying plants add much nitrogen to the soil, but this they obtained in the first place from the soil, as they have no power to gather nitrogen from the air, although their leaves are constantly bathed in an ocean of it. Therefore crops by growing and decaying can not increase the amount of nitrogen in the soil.

The amount gained each year from the air is very small, not more than from five to ten pounds on the surface of an acre. It is therefore a question of both interest and importance to know if there is any other source of nitrogen in the soil. On this point scientific men have differed, and long and warm have been the controversies over it. The writer of this article is of the opinion that there is another source.

All soils—at least all good soils—are porous, and the pores of the soil, when not filled with water are filled with air, four-fifths of which is nitrogen. Now we believe that under certain circumstances this nitrogen contained in the pores of the soil combines with oxygen, forming nitric acid, which remains in the soil, adding to the total amount of nitrogen it contains. The circumstances we believe to be essential are these:

Warmth.

A porous soil, moist but not wet, and containing a good proportion of decaying vegetable matter.

The presence of some alkaline substance, such as lime, in the soil.

As these are conditions of soil completely under the farmer's control, it is evident that if this theory is correct the farmer has it in his power to add to the nitrogen in his soil without the purchase of fertilizers from outside his farm; and as these conditions of soil are desirable on all accounts it is perfectly safe for the farmer to endeavor to add to the nitrogen in his soil in this manner. On the other hand, as this is as yet only an opinion and has not been demonstrated, it is perfectly safe for the farmer to be very careful about his farm and stable and allow no waste of this substance (nitrogen) which is one of the most essential for the growth of plants and one of the most expensive if it has to be purchased.

Purposes of Soil.—The soil serves a threefold purpose in the economy of nature.

1st. A bed to support the plant and afford protection and moisture to the roots.

2d. It furnishes a supply of food for the plants. Just as truly as animals eat and live upon the food set before them, so truly do plants live upon the soil. Although they get comparatively a small portion of their food from the soil (the greater part being obtained from the air), yet this portion is essential to their existence, and without it they have no power to take food from the air.

3d. The soil is a great chemical laboratory, in which material that is in itself inert and valueless is changed into forms capable of sustaining plant life. In any fertile soil this process goes on continually, except when stopped by frost. Through these changes a soil that seems barren and infertile may become fertile without any thing being added to it, and if this process is stopped or proceeds wrongly, a fertile soil may lose its fertility without any thing being taken from it.

Varieties of Soil.—The substances we have mentioned, phosphoric acid, potash, and nitrogen form but a small percentage (usually less than one per cent) of even a fertile soil. The remainder is composed of sand, clay, and the partially decomposed remains of plants, called humus. According as sand or clay predominate in the soil it is called a clay, a clay-loam, a

loam, a sandy loam, or a sand. When *humus* predominates largely it is called muck or bog soil.

Sand.—Perfectly pure quartz sand furnishes nothing for the sustenance of the plant. Some sands contain valuable mineral substances, which, in the laboratory of the soil, are gradually fitted for the use of the plant. Any kind of sand, if present in due proportion, is a valuable constituent in soil. It causes the soil to grow warm readily in the spring; it favors the escape of surplus water; it makes the soil porous, thus permitting the roots of plants to permeate it readily in search of food; it admits air to the soil, so essential for the chemical changes; it makes the soil easy to work. Excess of sand is a disadvantage. From its tendency to acquire heat, it may cause the roots to perish in hot weather; it is liable to permit too much of the water to escape in a dry season; it is liable to permit the water to pass through it so readily that the most valuable fertilizing elements will be leached out. Soils that are defective in this respect are called “leachy.” Sandy soils usually respond very promptly to the application of fertilizers, but the effect is usually short lived. Of all soils, sand has the least power of retaining moisture and elements of fertility.

Clay.—The presence of this substance in large proportion in a soil, renders it “retentive,” by which is meant that it has the power of retaining whatever is added to it, whether water or manure. Clay soils are generally “strong” soils, and wear well. They are less likely to be injured by bad treatment than other soils, and are more readily restored, after having been “run down.” A soil containing excess of clay, however, is apt to be heavy to work, difficult to drain, and “bakes” badly.

Humus.—The partially decayed vegetable matter to which this name has been applied, is one of the most valuable constituents of any soil. An artificial soil *can* be made which will support plant life perfectly, and which contains no *humus*, but practically all fertile soils contain *humus*, and the proportion of this substance is sometimes the measure of their fertility. It not only contains all the soil elements needed for plant life, but it also contains carbon, or charcoal, in large proportion.

This substance does not furnish any food to the roots of plants, but it has a wonderful power of retaining moisture, and the elements of fertility. In any ordinary soil it is always undergoing decay, and by this process the elements of plant food contained in the *humus* itself, and also those contained in the sand and clay, of which the remainder of the soil is composed, are set free in forms which the plant can use. When in excess, *humus* renders the soil light and chaffy, and it is commonly noticed that in reclaimed bogs and swamps, the soil, which is usually largely composed of this substance, though very productive at first, soon loses its fertility. This is due to the lack of sufficient mineral elements.

Humus is not a constant element in the soil. As we have already seen, it is always undergoing decomposition; the mineral matters it contains return to their original form, while the carbon, combining with oxygen from the air, is converted into carbonic dioxide, and escapes into the air. The more thoroughly the land is cultivated, the more rapidly does this process take place, and a soil that contains but a moderate per cent of *humus* may lose nearly all of it after a few years' persistent cropping and cultivating. Such a soil is said to be "run down," and though it may still contain in abundance the materials needed for the sustenance of plant life, it becomes infertile, because the chemical processes by which this material is made available for the plant proceed but slowly, unless there is a reasonable percentage of *humus* in the soil.

Changing the Character of Soil.—The gardener, with a small amount of ground yielding crops of great proportionate value, may find it profitable to change the character of his soil by hauling on clay if too sandy, or sand if it is a heavy clay, but in the operations of the farm, this is impracticable. *Humus* alone, of the three great constituents of the soil, can practically be controlled by the farmer. If it is in excess, he can diminish it by cultivation, and the use of lime and mineral manures. If it is deficient, it can be increased by growing clover, rye, buckwheat, or other similar crops, and plowing them under. The reader will also notice that it corrects the

defects of both sand and clay soils. Added to sand it makes it more retentive of moisture and elements of fertility. Added to clay, it makes it more porous and more easily worked. By the use of green crops plowed under to increase the proportion of *humus*, or by cultivation and use of lime to decrease its proportion, the farmer can thus change the character of his soil, and to a considerable extent make such a soil as he needs.

What Constitutes a Fertile Soil?—A fertile soil is one that is capable of yielding, under favorable conditions of season, large crops. The requisites of fertility are

1st. A sufficient supply in the soil of plant food—that is, of the material which the plant draws from the soil. In practical estimates we may consider this plant food to consist of nitrogen, phosphoric acid, and potash. There are other substances, such as lime, magnesia, sulphuric acid, and iron, which are equally essential for the growth and health of the plant, but as these are almost always present in sufficient quantity the real question of fertility rests on the first three named.

2d. The plant food in the soil must be in such a state of combination that the plant can use it. This is a point of the utmost importance. Many soils contain plant food in abundance, yet are infertile, because the material is in forms that the plant can not use. Where one piece of soil will be found that is unproductive on account of lack of plant food, a hundred can be found which produce but poor crops, though containing plant food in abundance, because the food is in forms which the plant can not use. It is not uncommon to find soils containing in the upper twelve inches from five thousand to ten thousand pounds of nitrogen to the acre, and which yet show greatly increased crops by the addition of thirty or forty pounds of nitrogen to the acre. Of course, such an addition would make no appreciable difference in the actual amount of nitrogen the soil contained, but the benefit was due to the fact that the thirty or forty pounds of nitrogen contained in the manure was in form that the crop could immediately use, while nearly all of the nitrogen originally in the soil was in unavailable forms.

3d. The fertile soil must contain sufficient moisture to supply

the needs of the plants, but must not be "water-logged." Experience has shown that the condition of soil, with regard to moisture, most favorable for plant growth, is that in which the particles of soil are moist, but the spaces between the particles contain no water.

4th. The soil must be in a state of minute division. The wonderful fertility of the soil in many river bottom lands is largely due to the fact that the particles of which they are composed are exceedingly fine. When the soil is in lumps, or even in large, coarse particles, the roots of plants can not draw from it the nourishment they need, nor can the chemical changes, so essential for fertility, proceed with any degree of rapidity.

5th. The soil must be in such condition that chemical action can proceed rapidly, whereby the plant food it contains may be rendered available.

It will be seen by this that the requirements of a fertile soil are many, and that an abundant supply of plant food is necessary. This food, instead of being, as has often been supposed, the one essential characteristic, is but one of several, all equally needful. We will usually find all these essentials in a soil that is composed of a due proportion of sand, clay, and *humus*; that is thoroughly drained, either naturally or artificially; that is kept in fine condition by thorough cultivation, and that is supplied with plant food by proper applications of manure.

Improvement of Soils.—There are three different methods by which soils may be improved, or by which the five essentials of fertility can be secured. These are Drainage, Cultivation, Manure.

Drainage.—We place this first because when needed, the improvement of the soil by the other two methods is impossible. Cultivation and manure are alike wasted on a water-logged soil. The practice of drainage is sufficiently explained in the chapter on that subject, and we will need here only to give a brief explanation of the scientific principles connected with it.

One of the essentials of fertility we have seen is such a condition of soil that chemical change can progress rapidly, constantly converting plant food into available forms. This

chemical action proceeds most rapidly when the soil is moist and warm, the spaces between the particles being filled with air. In the chapter on drainage it is shown that this condition of soil is secured by this method. When the soil is waterlogged this process of change ceases altogether, and hence manures applied to such a soil are without effect.

Drainage, therefore, not only secures the condition of soil best fitted for plant growth, but it also secures that chemical action essential to fertility.

When corn turns yellow and dies in a long wet spell, it is not because—as seems to be commonly supposed—the corn is “drowned out,” but because the presence of excess of water in the soil has stopped the chemical work, and the plant starves. There is plenty of food all around it, but the process by which that food is made available has ceased. The first question to be considered in the improvement of a piece of land is therefore: “Does it need draining?” If it does, this should first be attended to, as without it all other treatment will be ineffectual.

Cultivation.—By thorough cultivation the soil is pulverized and the quality of fineness secured. The soil is also more exposed to the air, and chemical change is thus facilitated. Cultivation should be preceded by drainage—when needed—and should usually be accompanied by the use of manure. Cases are on record of fields, which had become almost barren, but were restored to fertility by thorough cultivation. Cultivation to a small extent adds to the amount of plant food in the soil, as by exposing so much surface to the air it causes an increased absorption of ammonia from the air, but its principal value consists in the fact that it renders available material already present in the soil.

Manures.—These are usually divided into three classes—barn-yard manures, green manures, and commercial manures. They act in two different ways: first, by supplying plant food; second, by rendering available plant food already present. Some manures act in one way, some in the other, and many in both.

Barn-yard Manure.—This varies greatly in value according to the animals it is obtained from, the food on which they are fed, and the care with which it is treated. The actual value of the manure comes in all cases from the food, and not from the animal. No animal can put into the manure heap any substance that was not contained in the food, and the manure produced from any animal can never contain any more plant food than was contained in the food the animal consumed.

There has been much misconception on this subject, and many persons have imagined that a field could be enriched by simply pasturing sheep on it. The manure produced by the sheep will be valuable, but it can not by any possibility be of more value than the crop they ate off would have been if turned under, except in the fact that it might decompose in the soil more rapidly. Poultry are often spoken of as being of great value because they produce such rich manure, and some enthusiastic individuals have claimed that poultry would pay for their feed in their manure. But the manure produced by a flock of poultry while eating a bushel of corn *could* not contain any more plant food than was contained in the corn, and in fact would contain somewhat less. Nevertheless, there is a difference in the value of the manure according to the animal producing it, which arises from two causes.

First. Some animals take more plant food out of the food given them than others, and so leave less of it in the manure. The manure produced from a ton of corn fed to animals which are neither giving milk nor gaining in weight, will contain almost precisely the same amount of nitrogen, phosphoric acid, and potash that was contained in the corn. But if the ton of corn is fed to cows giving milk or to young animals that are growing rapidly, the manure produced will not contain more than from fifty to seventy-five per cent of the nitrogen, phosphoric acid, and potash that was contained in the food. Hence the value of manure produced from a given amount of food will vary much, according to the animal to which the food is given, not because any animal can add to the amount of plant

food contained in the food given it, but because some take out more of it for their own use.

In general it may be said that the loss of nitrogen, phosphoric acid, and potash in feeding will be: in feeding animals that are neither growing nor giving milk, practically none; in fattening full grown animals, from five to ten per cent; in young animals that are growing rapidly or giving milk, from twenty-five to fifty per cent. In common farm practice the real loss is always much heavier than this because the manure is never entirely saved. All scientific calculations must of course be made with reference to the whole amount of manure produced by the animal. The farmer must make his own calculation as to how much of this manure he allows to go to waste.

Second. Some animals produce a larger quantity of manure from a given quantity of food than others, which of course makes it worth less per pound. This is due to the fact that some animals consume in their systems a larger proportion of the carbonaceous matter in the food than others and also because some animals drink more water than others. To illustrate: If ten bushels of corn were fed to a fattening steer, and another ten bushels fed to a flock of fattening poultry, there would be very little difference in the value of the two *piles* of manure, but the pile made by the ox would be three or four times as large as that made by the poultry. The latter would be worth three or four times as much per pound.

The food given to the animal which produces the manure has a great influence on its value. This is evident from what has already been said. The manure made by an ox while eating a ton of bran will be worth more than that made by another ox while eating a ton of corn, which again will be worth a great deal more than that made by another ox while eating a ton of straw. This result is inevitable: poor food makes poor manure; rich food makes rich manure. In making a selection of foods it is always a matter of importance to consider what will be the value of the manure produced. If the farmer wishes to buy fertilizers from outside his farm, there is usually no more profitable way than to buy good food and feed it to stock on his farm:

that is, if he takes care of the manure. The treatment of the manure makes a great difference in its value. There are three sources of loss :

First—*Leakage*. Many farmers make little attempt to save the liquid manure. By reference to the tables given further on in this chapter, it will be seen that one ton of horse urine is worth about as much as ten tons of solid manure from cattle. It will thus be readily understood that the quality of the manure will be greatly depreciated if the liquid is allowed to escape and only the solid saved.

Second—*Leaching*. Much of the plant food in manure is in insoluble forms, but there is a portion that can very readily be washed out. Therefore, if the manure pile is kept where so much water will fall on it that it will leach through it, great loss will be incurred. Whenever the farmer sees a stream of dark-brown liquid draining from his manure pile, he may be sure that much of the richness of his farm is leaking away. The better the quality of the manure the more it is likely to be injured by leaching, as the more soluble matter it will contain.

Third—*Heating*. When manure is thrown into a pile it soon grows warm, and decomposition commences. If the manure is sufficiently wet to prevent this process from being too rapid or going too far, the manure will be benefited and no loss be incurred; but, if it proceeds so rapidly that the pile gets dry inside and the smell of ammonia is perceptible, the farmer may know that one of the most valuable substances (nitrogen) is escaping.

Fermentation of Manure.—Barn-yard manure, we have seen, consists of a large bulk of material containing a small amount of certain valuable substances. The composition of a ton of average fresh barn-yard manure is about as follows:

Water,	1,420	lbs.
Carbonaceous matter, etc.,	556.4	"
Nitrogen,	9	"
Phosphoric acid,	4.2	"
Potash,	10.4	"
Total,	2,000	"

When manure undergoes fermentation, a considerable portion of the carbon unites with oxygen from the air, and escapes in the form of gas. The heat which this occasions drives off part of the water, and, if the process is properly managed, the total weight of the heap may be reduced one-half without any appreciable loss of nitrogen, phosphoric acid, or potash, and the manure that is left will be worth twice as much per ton. This will not be because the fermentation has added any thing to the heap, but because it has reduced the total quantity in the heap without reducing its total value. It is evident that, if a farmer had a heap of manure weighing twenty tons, and worth forty dollars, if it could be reduced to ten tons and still be worth forty dollars, the smaller pile would be worth twice as much per ton as the larger one had been.

Another advantage gained by fermentation, and thus reducing the bulk, is that the cost of hauling and spreading is reduced. Farmers who buy manure in town and haul to their farms will often find the expense of hauling fresh manure is greater than its value, while a pile of old and thoroughly rotted manure may be a profitable purchase.

Fermenting manure also improves it by rendering the plant food it contains more soluble. In fresh manure nearly all the nitrogen is in combinations which are not available to the plant, and it only becomes available as the manure undergoes decomposition, either in the manure heap or in the soil; and, as this process is much more rapid in the manure heap than in the soil, there is an advantage in having the manure thoroughly fermented in the heap.

In these calculations we have supposed that the carbonaceous matter in the manure was of no value in the soil. It is of no value as plant food, but it has a value when the soil is deficient in *humus*, as by its decomposition it is converted into that substance, which is so essential to a fertile soil. At the same time the *humus* in the soil can usually be increased more cheaply by plowing under green crops than by hauling out manure. Therefore, the great object in manure should be to secure the largest proportion of plant food; but the carbonaceous matter it con-

tains will not be without value, especially on sandy or clayey soils.

Green Manures.—As the practical instructions concerning green manures are given in the appropriate chapter, we here need to consider only the scientific principles connected with their use.

When a farmer grows a heavy crop of clover or rye, and plows it under, he adds to the soil a large amount of vegetable matter—perhaps eight tons to the acre. The composition of this would be about as follows:

Water,	. . . . .	12,600 lbs.
Carbonaceous matter,	. . . . .	3,100 "
Lime, sand, etc.,	. . . . .	120 "
Nitrogen,	. . . . .	80 "
Potash,	. . . . .	78 "
Phosphoric acid,	. . . . .	22 "
Total,	. . . . .	<hr/>16,000 "

Of this, the one hundred and eighty pounds of nitrogen, phosphoric acid, and potash are valuable plant food, and were all obtained from the soil. The carbonaceous matter was obtained from the air, and is not plant food. The question, then, naturally arises: "Seeing that all the plant food which this crop adds to the soil was taken from it by the crop, how can the soil be enriched by the process? Does a man get rich by taking a dollar out of his pocket and then putting it back again?"

It must be remembered that there are two ways of improving the soil: one by adding plant food to it, the other by rendering available that which it already contains. The green crop enriches the soil by the latter method. The clover plant gathers from the soil large quantities of plant food which other plants can not use, and when it decays in the soil it leaves this plant food in available forms. It also sends its roots deep into the soil, and gathers food which is out of reach of other crops; when it decays it leaves this in the surface soil, within reach of other crops. But it has yet another effect: By keeping the soil moist and shaded, and full of decaying vegetable matter, it furnishes

just the conditions needed for those chemical changes by which plant food is changed from inert into available forms.

There is also always a risk of loss of fertility by drainage. As the plant food is rendered soluble by chemical action, it may be washed out by a sudden heavy rain. Clover saves this waste by taking up the material as rapidly as it is rendered soluble, organizing it into forms which will not waste, but can be readily used by the succeeding crop. As this waste from drainage is most likely to occur in the latter part of the summer and early fall, the great advantage of sowing clover with wheat becomes apparent. Experiments have shown that, if the soil is left bare after the wheat is cut, there will often be more fertility lost by drainage than was taken up by the crop.

If the theory referred to in the beginning of this chapter—that, under certain conditions and in some climates, the nitrogen in the soil may be increased by chemical action—then it is probable that, in warm climates, on suitable soils, clover actually causes an increase of nitrogen in the soil. This point, however, is not yet established, and, while it favors clover, should not be depended on.

Another question will probably occur to the reader: “If clover adds no plant food to the soil, but only enables the succeeding crop to draw more heavily on the original supply, will not the constant use of green manures, unaccompanied by the addition of plant food, either in barn-yard manures or commercial fertilizers, bring about the ultimate exhaustion of the soil more rapidly than continuous cropping without clover?” The answer must be that, with regard to phosphoric acid and potash, it certainly will; and, unless the theory already referred to concerning nitrogen is true, the result will be the same with it.

Sir J. B. Lawes, the great English experimenter, found that a plat which he cropped alternately with clover and wheat, through a long term of years, showed at the end of the period a much greater reduction in the percentage of plant food in the soil, than another plat which he cropped continuously with wheat, no manure being used in either case.

But the ultimate exhaustion of the soil is not a thing so

easily reached as is commonly supposed. No soil that was originally fertile has ever been entirely exhausted of plant food by cropping alone. A soil of ordinary fertility contains in the upper twelve inches plant food enough—could it all be utilized—to produce a crop of thirty bushels of wheat per acre every year for two hundred years, supposing the entire crop to be removed and nothing returned. Of course, it is not possible to draw from the soil in this manner, but these facts show that it is a matter of fully as much importance to know how to render available the plant food the soil already contains, as to apply more. Of course this wonderful abundance of material provided by nature should not cause the farmer to be prodigal or wasteful of this supply, but the farmer who uses clover or other green manures intelligently and in connection with barn-yard manures, and a proper rotation of crops, need have no fear of reaching the ultimate exhaustion of his soil.

Fallow.—In olden times the system of summer fallowing was largely relied on for the improvement of soils. It was called “resting the land,” an erroneous term, as the soil being simply passive in the matter of producing a crop, can need no rest. Experiments have shown that a field cropped with wheat each alternate year, and cultivated as a fallow the intervening years, produced more wheat in a given time than another field cropped continuously.

By fallowing, nothing is added to the land except a little ammonia, which is absorbed from the air by the exposed surface. The gain of fertility is due to the fact that by the exposure to the air, and constant stirring, chemical changes are induced by which plant food in the soil is rendered available. Fallowing is, therefore, similar in principle to green manuring, but is inferior to it, the disadvantages being :

A crop is lost the fallow year.

The *humus* in the soil instead of being increased is decreased.

It costs more to keep the soil constantly stirred than to grow a crop of clover.

The chance of a gain of nitrogen under the influence of shade,

moisture, and decaying vegetable matter is lost. There is liable to be a great waste of fertility by drainage, and if a field that has been kept stirred in fallow through a hot summer receives a long, heavy, drenching rain in the fall before the crop has started, it is possible for a large part of the liberated fertility to be washed out and wasted.

Commercial Manures.—We consider under this head the various fertilizing materials usually bought off the farm.

LIME.—This has been long in use for the improvement of the soil. All crops contain lime, and yet it is difficult to imagine that lime is valuable as a fertilizer, by supplying plant food, for nearly all soils contain it far in excess of the needs of any crop. But lime acts in improving the soil in a twofold manner. On heavy clay lime is valuable, as it renders it more easily pulverized and less adhesive. This not only makes it more easy to work, but enables the roots of plants to penetrate it more readily.

Lime, also, has the effect of causing the decomposition of vegetable matter in the soil. Hence, when lime is added to soils rich in vegetable matter, this is rapidly decomposed and rendered useful. Lime, therefore, improves the soil by rendering available the plant food it already contains, and it does this at the expense of the humus. Hence has arisen the proverb:

“Lime and lime without manure,
Will make both the farm and the farmer poor.”

There are instances where lime has been continuously used for a long course of years without either green crops or barn-yard manure, resulting in reducing the soil almost to sterility. Properly used, however, lime is a valuable material for increasing the fertility of the soil. Its chief use should be:

1. On heavy clays to render them more easily worked. In this case its application should be accompanied by green manuring to avoid too greatly reducing the amount of humus in the soil.
2. On soils rich in vegetable matter, which has but partially decayed. It is specially valuable on reclaimed swamps and bogs.
3. In connection with barn-yard or green manures to render their action more prompt. When lime and barn-yard manure are used in connection, the manure should be thoroughly mixed with

the soil before the lime is added. In no case should barn-yard manure and lime be mixed, as loss of ammonia is certain to result.

There is yet another manner in which lime is beneficial. When vegetable matter undergoes decomposition in the soil where there is an excess of water, and consequent deficiency of air, certain organic acids are formed in the soil which are injurious to vegetations. This is indicated by the growth of moss and plants like red sorrel. When lime is added to a soil in this condition, it combines with these acids, forming harmless compounds. Draining such land by removing the water, and admitting the air, overcomes the cause of "sourness."

GYP SUM.—*Land Plaster.*—The beneficial action of this substance has never been fully understood, but some recent experiments seem to show that when sprinkled on the clover, it is absorbed by the leaves. If this is the fact, the benefit derived from plaster probably arises from its furnishing lime to the plant in a soluble form, as plaster is the most soluble of any of the ordinary compounds of lime.

BONE MEAL.—This important fertilizer is or should be simply bones reduced to powder. The object of the grinding is to cause the bones to undergo decomposition in the soil more rapidly. It contains all the important elements of plant food in large proportion. Bones are entirely insoluble in water, but when mixed in the soil with decaying vegetable matter they undergo decomposition and are changed into available plant food. The more finely they are ground the more rapidly this decomposition proceeds. As the presence of vegetable matter is essential, it is found that bones act more rapidly when applied to a sod.

ROCK PHOSPHATE.—In South Carolina and some other countries immense deposits of phosphate of lime are found. This, when reduced by grinding to a fine powder, is known as rock phosphate, and is valuable as a manure for the purpose of supplying phosphoric acid. Like bones it is more rapid in its action when applied to soil containing decaying vegetable matter, and hence is most useful on sod ground. It contains no nitrogen and would seem to be best adapted to lands over-rich

in vegetable matter. The acids produced in such soils decompose the phosphate, rendering it more soluble and the acids harmless.

SUPERPHOSPHATE.—Phosphoric acid in bones, or rock phosphate, is in combination with lime; in form called by chemists tricalcic phosphate. This form is very insoluble. When an acid such as sulphuric is added to this tricalcic phosphate it takes part of the lime, and of course the compound of lime and phosphoric lime that is left, containing less lime, has a larger proportion of phosphoric acid. This new combination is known by chemists as bicalcic and mono-calcic phosphate, according to the amount of lime that is removed, but it is commonly known as superphosphate. Its advantage as a fertilizer over bones or rock phosphate arises from the fact that it is more soluble. Rock phosphate is often converted into superphosphate by treatment with acid, and is then called "Dissolved Rock."

Commercial "superphosphate" is a substance of very uncertain composition. It is usually made from bones treated with acid, to which is added slaughter-house refuse, nitrate of soda, and sometimes other more questionable materials to bring up the per cent of nitrogen. Much of it is made by treating the refuse bone black of the sugar refineries with acid. As the bone black contains phosphoric acid but no nitrogen, either slaughter-house refuse or nitrate of soda is usually added to make it show a due proportion on analysis. When superphosphate is mixed with the soil it often combines with more lime, and returns to its original condition of "bone phosphate" or tricalcic phosphate; but this new formed phosphate is in a state of such fine division that it is readily acted on by the roots of plants.

GUANO.—This is the excrement of sea-fowls, which in some of the Pacific islands has accumulated for ages. There are two kinds, one found on islands where rain never falls. This is rich in nitrogen, potash, and phosphoric acid. The other kind has had the nitrogen and potash washed out by the rains, and contains phosphoric acid only. This latter kind is often treated with sulphuric acid and converted into superphosphate before being sold.

These commercial fertilizers are all valuable solely for the plant food they contain, having no beneficial action on the soil, such as is produced by barn-yard manure or green crops.

Valuation of Fertilizers.—It would of course be impossible to adopt any standard of valuation which could show exactly what any particular fertilizer would be worth to the farmer. That would depend on his soil and crop. A certain fertilizer might, from the nitrogen it contained, be worth forty dollars a ton, and yet on some field or crop that did not need nitrogen it would be worth nothing. But for convenience in comparison experiment stations have adopted certain standards of value for nitrogen, phosphoric acid, and potash. By these standards the intrinsic value of different fertilizers can be determined, and by their means and analysis a farmer can determine whether he is paying more for a fertilizer than it is really worth, and he can compare the value of commercial fertilizers with barn-yard, and he can compare different kinds of barn-yard manure with each other.

The same article of plant food has a different value, according to the condition it is in. A pound of nitrogen in nitrate of soda is worth more than a pound of nitrogen in barn-yard manure, for the nitrogen in the former article will be almost all, and immediately available for the use of the crop, while the nitrogen in the latter may have to lie in the soil for many years before it will be converted into available forms. We shall give in this book the valuations adopted by the Ohio State Board of Agriculture.

	Value per pound.
Ammonia,	18 cts.
Which is equal to nitrogen,	21.86 "
Phosphoric acid in compounds which are soluble in water, and which is described in official analysis as "soluble" phosphoric acid,	12 cts.
Phosphoric acid in compounds which though insoluble in water are yet available as plant food, and which is described in official analysis as "reverted phosphoric acid,"	10 cts.
Phosphoric acid in insoluble compounds which must undergo decomposition in the soil before being available as plant food, and which is described in official analysis as "insoluble phosphoric acid,"	5 cts.
Potash,	6 "

These valuations have been agreed upon for commercial fertilizers. As the condition of plant food in barn-yard manures is seldom twice the same, the determination of a standard of valuation for them is both difficult and uncertain. A pound of nitrogen in the manure from highly fed cattle will be worth more than a pound of nitrogen in the manure produced by those which have been poorly fed. An average estimate is therefore the best that can be obtained. In preparing my work, *Science in Farming*, I adopted the following standards of value, and have not since seen reason for making any change:

VALUE OF PLANT FOOD IN MIXED MANURE.

Nitrogen,	15 cents.
Phosphoric acid,	8 "
Potash,	5 "

VALUE OF PLANT FOOD IN SOLID EXCREMENT.

Nitrogen,	10 cents.
Phosphoric acid,	6 "
Potash,	4 "

VALUE OF PLANT FOOD IN URINE.

Nitrogen,	22 cents.
Phosphoric acid,	12 "
Potash,	6 "

VALUE OF PLANT FOOD IN FOODS.

Nitrogen,	15 cents.
Phosphoric acid,	8 "
Potash,	5 "

I give now the following table, taken from *Science in Farming*, showing the composition of various barn-yard manures, and their values according to the above standard. The calculations are made for one ton of each kind:

Name of Manure.	Nitrogen, lbs.	Phosphoric Acid, lbs.	Potash, lbs.	Value.
Fresh barn-yard manure,.....	9	4.2	10.4	\$2 21
Fresh hen manure,.....	32.6	30.8	17	8 20
Dried hen manure,.....	65.2	61.6	34	16 41
Solid excrement, horses,.....	8.8	3.4	7	1 36
“ “ cattle,.....	5.8	3.4	2	86
“ “ sheep,.....	11	6.2	3	1 59
“ “ swine,.....	12	8.2	2.6	1 79
Urine, horses,	31	...	30	8 62
“ cattle,	11.6	...	9.8	3 14
“ sheep,.....	39	0.2	45.2	11 31
“ swine,.....	8.6	1.4	16.6	3 06

The low value of the urine of cattle and swine is largely due to the amount of water they take with their food.

This table does not show what any particular manure will be worth to the farmer, as that will depend on the soil and crop, but it does show the comparative value. A ton of dried hen manure may not be worth to the farmer \$16.41; but if not, then a ton of solid cattle manure will not be worth 86 cents; and, if the ton of solid manure from cattle is worth more than 86 cents, then the ton of dried hen manure will be worth more than \$16.41.

Food and Manure.—As we have seen that the value of the manure all comes from the food, and not from the animal, it is often important to know what will be the value of the manure produced from a ton of food. This will depend not only on the food, but on the animal: for, although animals can not add any thing to the manure, yet some take up more of the valuable constituents of the food for their own use than others.

The following table, which is taken from *Science in Farming*, gives the amount of nitrogen, phosphoric acid, and potash in different foods, and their value according to the standard already given. It differs slightly from the one prepared by Sir J. B. Lawes, which has been so extensively published, as the valuation of fertilizers in this country and England is somewhat different.

In using this table it should be remembered that the manure made from a ton of any of these articles, when fed to fattening animals, will be worth about ten per cent less than the figures here given, and that, when the food is given to young, growing animals, or animals giving milk, the manure will be worth from twenty-five to fifty per cent less than the figures given. It should also be remembered that the estimate thus obtained will be the value of the total amount of manure produced, and the farmer must calculate for himself how much he will allow to be wasted. The plant food in manure produced from foods that are largely digestible will be more soluble, and, therefore, more promptly available than that in manure made from poor food.

AMOUNT AND VALUE OF THE MANURIAL CONSTITUENTS CONTAINED IN ONE
TON OF DIFFERENT FOODS.

Name of Food.	Nitrogen, lbs.	Phosphoric acid, lbs.	Potash, lbs.	Value.
Linseed cake,	90.0	39.2	29.4	\$18 10
Cotton cake, decorticated,	132.0	62.4	30.0	26 29
“ “ undecorticated, ..	78.0	45.8	40.2	17 37
Beans,	82.0	23.2	24.0	15 36
Peas,	72.0	17.6	19.6	13 18
Bran,	44.0	64.6	29.6	13 25
Oats,	41.2	12.4	9.0	7 62
Barley,	34.0	14.6	9.8	6 76
Indian corn,	33.2	12.2	7.2	6 32
Clover hay,	39.4	11.2	39.0	8 76
Meadow hay,	31.0	7.6	33.6	6 94
Wheat straw,	9.6	5.2	11.6	2 44
Barley straw,	10.0	4.0	19.4	2 79
Oat straw,	10.0	5.0	20.8	2 94
Pea straw, cut in bloom,	45.8	13.6	46.4	10 28
“ “ ripe,	20.8	7.0	20.2	4 69
Corn-stalks,	9.6	10.6	19.2	3 25
<i>Green Fodder—</i>				
Grass,	10.8	3.0	9.2	2 32
Red clover,	10.2	2.8	8.8	3 37
Peas,	10.2	3.0	10.2	2 50
Oats,	7.4	3.4	15.0	2 73
Rye,	10.6	4.8	12.6	2 60
Corn,	3.8	2.6	8.6	1 21
Hungarian,	20.0	2.5	17.0	4 05
Sorgum,	8.0	1.6	7.2	1 69
<i>Roots—</i>				
Potatoes,	6.8	3.6	11.2	1 87
Mangels,	3.8	1.4	7.8	1 07
Carrots,	3.2	2.0	6.4	96
Turnips,	3.6	1.2	5.8	92

Summary.—We have seen how the soil was formed during the countless ages of the past—how from the rocks and air were gathered the exact materials needed to make a soil. We have seen what a wealth of material has thus been placed under our feet. So great is this wealth that if the nitrogen, phosphoric acid, and potash contained in the upper twelve inches of a good soil were valued at the prices charged for them in a commercial fertilizer the soil of a farm of one hundred and sixty acres would be worth about a half million dollars.

It is the duty of the farmer to wisely husband and use this

wealth, not to squander it, but to develop it, use it, and finally return it to the soil from whence it came. The development of this wealth is accomplished by drainage, cultivation, and green manures, and sometimes by the use of lime. The husbanding of it is accomplished by growing, as far as possible, those crops that can be fed on the farm, and by avoiding all wastes of manure, particularly of the liquid portion. For the improvement of the soil we may safely adopt the following rules :

Drain all land that requires it, not only removing surplus water but admitting the air, without which development of plant food can not take place.

Cultivate thoroughly, thus still further favoring chemical action.

Keep the surface of the soil, when not growing a cultivated crop, in grass or clover, thus avoiding waste of fertility by drainage.

Adopt such a rotation of crops as will give every cultivated field a term in clover every few years. The exception to this last rule is in the case of fields over-rich in *humus*.

Use lime only on land over-rich in humus, or in connection with green crops or barn-yard manure.

Feed on the farm all crops that you can, and if you sell grain largely, strive to balance the loss by the purchase of bran, or other food from outside the farm.

CHAPTER VI.

GRASSES AND CLOVER.

TO get a true idea of the value of the grass crop of the country requires some thought and study. When by study and comparison we see the many products of the farm which come directly or indirectly from this crop, we shall realize that in it is the farmer's wealth. Not only does the bulk of his income often come from the grass crop, but it comes with less labor and loss of fertility than from any other. A few statistics will prove this.

The last compendium of the census puts the hay crop of the United States in round numbers at 35,000,000 tons, and this at \$10 per ton is worth \$350,000,000. The butter product is placed at 806,672,071 pounds, worth at 20 cents a pound, \$161,334,414. Of cheese we produce 243,157,850 pounds, worth, at 10 cents a pound, \$24,315,785. Of wool 155,000,000 pounds, worth at 25 cents a pound, \$38,750,000. These three items, butter, cheese, and wool, may be said to be almost entirely the product of grass. The entire valuation of the live stock of the United States is \$1,500,000,000, and it would be a very moderate estimate to allow that one-half of this is due to the grass crop, for nearly two-thirds of the value of all our live stock is cattle and sheep, and much more than half of their value comes from grass.

It is a little difficult to know what part of this stock is disposed of each year, but I should think it a fair estimate to add \$200,000,000 to the income from grass for this item, and this added to the value of the hay, butter, cheese, and wool, gives an aggregate value to the annual grass products of the farms of the country of about \$774,400,199. The annual wheat crop is

about 450,000,000 bushels, and worth on an average the same number of dollars, and the annual corn crop at forty cents per bushel would bring about \$700,000,000.

In getting at the relative values of these different crops it must be remembered that the expense of each acre of corn, or wheat, for plowing, harrowing, seed, and harvesting, will on an average amount to nearly or quite half the value of the crops. Grass, however, being usually sown with small grain, requires no special preparation of soil, and as a single seeding lasts from two to an indefinite number of years, the expense to be charged to the crop amounts to a very small per cent of its value.

That a system of farming which keeps a large per cent of the land in grass will, under right management improve the soil, scarcely needs an argument, for every farmer knows; first, that continual cropping in grain always reduces the fertility of the soil, and, second, that the cheapest plant food at the farmer's command is a decaying sod. A proper proportion of grass on the farm enables us to follow a wise rotation of crops, and to grow stock to consume the grain, straw, and fodder, and thus produce the manure which is indispensable to good farming.

Farms which on account of a rolling surface, and the quality of the soil would soon be ruined by washing if cultivated in grain, can be kept in good condition by keeping them seeded to grass. I have seen this illustrated along the "Big Miami River." For some twenty miles above its mouth the bluffs will average about three hundred feet high, and on the farms whose owners have persisted in cultivating them these hill-sides are now barren, seamed, and gullied, so that they can never produce grain again; and even to get them set in grass will require the planting of trees and building of dams in the washes, and will be a work requiring long time and great labor, and even then the grass product of these hill-sides will be small compared with those which have been kept in grass and thus saved from this loss. Often on the adjoining farm will be seen hill-sides just as steep, clothed from base to summit with a velvety sward of blue grass, which starts into rapid growth with the first warm days of

spring, enabling the farmer to pasture his stock a month before the clover fields are ready. I am aware of the fact that farms may be reduced in fertility while kept in grass, when pastured close in summer and little or no manure applied to them; and I have seen examples of this among the factory dairies, where the cows are wintered on hay alone and no rotation followed.

Varieties.—Botanists have classified about four thousand species of grass, and there is no soil but some of them are adapted to. When we name those of value to the farmer, however, we reduce the list to a small number of varieties, and for much the larger part of the United States four will very nearly cover the list. These are timothy, blue-grass, orchard-grass, and redtop. Through a wide scope of territory with which I am familiar—if we except clover and the millets—these are the only grasses ever sown. There are other varieties which are valuable for certain localities or special purposes, among which may be named the following: Meadow, fox-tail, fowl meadow, rough stalked meadow, perennial rye grass, English bent, meadow fescue, and sweet-scented vernal.

TIMOTHY.—Of the varieties named, all things considered, this is the most valuable. It forms a large proportion of all the hay sold in our markets, and is the standard of value for this purpose. It contains a large percentage of nutritive matter. It thrives best on loamy soils, or a rich clay, and is not well suited to light or sandy lands. On moist soils its roots are fibrous, and on dry, loamy ones bulbous. On rich lands, well suited to it, this grass makes a rapid growth, and will sometimes yield from three to four tons of cured hay per acre. It is not well suited for pasture, as it is soon killed out by close grazing, and in a dry fall will make very little, if any, aftermath. When sown for pasture, therefore, it should always be in connection with other grasses.

BLUE-GRASS.—This is known in many localities as “June grass,” and it varies much in size and appearance on different soils. It flourishes best on limestone lands, and is universally esteemed for pasture. It starts early, and forms a turf which can be tramped with little injury when the land is in a condition

that would not admit of pasturing many other varieties. The grass is nutritious, and stock fatten rapidly on it, and it is not in the least injured by close cropping. It is seldom injured by the frosts of winter. As it starts slowly, and requires at least four years to become well set, it is not advisable to sow it on level plow lands; but on all soils where it flourishes, it should always be sown with other grasses for permanent pastures. It should be sown during the winter, that the melting snows and the freezing and thawing may cover it, so that it will start in early spring. Wherever it gains a foot-hold, it will, in time, crowd out all other grasses. It is claimed that it will catch as well on the hard surface of an old pasture as on a mellow field. It is usually recommended to sow about four pounds of this seed to the acre in connection with other grasses, but I would not sow less than twice that amount, and believe that one bushel (14 pounds) is none too much. I would not sow old seed, as I doubt if it will germinate, and to know that you get new seed will require care, as much seed is held over and sold the second year, or later.

ORCHARD-GRASS.—also called Rough Cocksfoot, stands pre-eminent as a pasture grass. It possesses a host of good qualities. It is palatable and nutritious, and makes a very rapid growth. It blossoms early, and when pastured close or cut, makes a luxuriant aftermath. It resists drought well, and is less exhaustive to the soil than Timothy. The seed weighs twelve pounds to the bushel, and when sown alone requires two bushels to the acre. When sown with a mixture of other grasses for pasture, about one-fourth the above amount is best. I have succeeded best with this grass sown in the spring with oats or barley. It forms an admirable mixture with red clover, either for pasture or hay, as it blossoms about the same time, and keeps the clover from lodging.

RED-TOP.—This grass is called herds-grass in Pennsylvania, and is known by many local names, and assumes a variety of forms on different soils. It is well adapted to a great variety of soils, but flourishes best on a moist loam. It makes a heavy crop of hay, but inferior in quality to timothy. It is well suited

to permanent pasture, as it bears close feeding, but if allowed to run to seed, it becomes wiry and unpalatable to cattle. It endures all the vicissitudes of heat and cold, wet and dry, as well as any grass we have, and should form part of the mixture for permanent grass lands. As the seed is very fine, only a small quantity will be needed.

MEADOW FOXTAIL.—This grass resembles timothy, but is earlier and has a softer spike. It is not valuable to sow by itself for a crop, but a little of it in a permanent pasture will add greatly to its value. It requires three or four years to get a firm footing in the soil. The seed weighs but five pounds to the bushel, and contains over seventy thousand seed to the ounce. Two pounds of seed is enough for an acre.

FOWL MEADOW GRASS.—This variety is of great value for low, marshy grounds, where it flourishes best. It is one of the most nutritious of grasses. It thrives best in mixture with other grasses, and should be sown on all rich, moist lands, whether seeded for pasture or hay.

ROUGH STALKED MEADOW GRASS.—This resembles the June grass, but can be distinguished from it by its having a rough sheath, while the former has a smooth one. It grows best on moist, sheltered meadows. It is quite nutritious, and the second crop more so than the first. Seven pounds of seed to the acre will form a good sward, but it is better to sow two pounds of it in mixture with other grasses.

PERENNIAL RYE GRASS.—This grass is more prized abroad than in this country. It is better adapted to a wet climate than to one where drought is as common as with us. It is quite palatable and nutritious up to the time of blossoming, when it changes rapidly from a palatable and succulent plant to one with much woody fiber, and but little soluble matter.

ENGLISH BENT GRASS.—This is much like red-top, but may be distinguished from it by the roughness of the sheath when the hand is drawn down from above. Its qualities are very similar to those of red-top.

MEADOW FESCUE.—This is said to be identical with the Randall-grass of Virginia. It is a good pasture grass, and ripens its

seed very early. If sown it should be in a mixture with other grasses. Its greatest value is when in flower.

SWEET-SCENTED VERNAL GRASS.—This is not a palatable or nutritious grass, but it comes very early in the spring and grows late in autumn, and in a mixture for pasture is of some value. It derives its name from its sweetness of smell when partly wilted or when crushed in the hand, and it is this, chiefly, that gives the fragrance to new mown hay. It is rarely sown, but comes spontaneously into fields and along roadsides.

Of the varieties of grass named the blue-grass and orchard-grass do best in the shade, and will produce heavy crops in orchards and timber groves. Botanists speak of dislikes and affinities among plants, and blue-grass and the locust tree seem to illustrate the latter, for they grow together with no apparent injury to each other. I have seen a second crop of locust trees grow large enough for posts in twelve years, in a heavy blue-grass sward, and our most dense groves of locust timber produce about as much of this grass as the open fields.

The length of time land should remain in grass must be determined by the character of the land and the system of farming pursued. On every farm there should be a permanent pasture; and, if this is seeded with a mixture of the grasses recommended, those best suited to the soil will get possession and become permanent. In all locations where blue-grass flourishes it will crowd out all others, and the land will not need reseeding in a generation. These pastures become more valuable with age, and are often the most profitable lands on the farm. On level plow lands, where the object of growing grass is to improve the soil, as well as for hay and pasture, the period the land should remain in grass will vary somewhat. In most rotations the period will be two years, and sometimes a poor catch, or the damaging of the crop by a very dry summer or an unusually severe winter, will make it wise to plow up the land after one year. Again, a field may be so well seeded and prove so productive that it will be found profitable to allow it to remain in grass for a series of years. I have known timothy meadows to give from four to six good crops from a single seeding.

On all plow lands the farmer should strive to so manage as to grow a heavy sward as soon as possible. This will often prove as valuable for manure as the crop will for food. If the farmer can accomplish this in two years he may be said to have grown three crops in this time,—two of grass, for pasture or hay, and one (beneath the soil) of plant food for succeeding crops. To secure this sward the land must be thoroughly prepared and heavily seeded. When fine, delicate seed like that of most of our grasses is sown on a rough, clayey surface, a large part of it never comes up at all, as it is covered so deeply that the germs perish before reaching the surface. It is of the greatest importance that the land be made fine and mellow, and, fortunately, this also gives the best seed-bed for the small grains with which our grasses are usually sown. It is of much greater importance that two or three inches of the surface soil be fine and mellow than that the land be deeply plowed. One is not likely to err by using the plank-drag too much.

I think, as a rule, that farmers are too sparing of seed, and that the best results will follow heavy seeding. I have often known farmers sow a bushel of timothy seed on ten acres, and think they were seeding liberally. I recommend, when timothy is sown alone for meadows, that a bushel be sown to three acres, and when seeding land for permanent pasture I would seed heavily with a mixture of as many valuable varieties as I could command that were suited to the soil. In seeding a pasture which is to remain permanently in grass, I would recommend as a suitable quantity for an acre:

Timothy,	.	.	.	.	.	.	.	.	.	10 lbs.
Orchard-grass,	.	.	.	.	.	.	.	.	.	6 "
Red-top,	.	.	.	.	.	.	.	.	.	2 "
Blue-grass,	.	.	.	.	.	.	.	.	.	7 "
Clover,	.	.	.	.	.	.	.	.	.	4 "

There is no economy in stinting the seed for grass land. Most of our grasses do best when sown with small grain, and, as this saves the labor of preparing a seed-bed specially for the grass, it is economical to do so. It occasionally becomes necessary, however, in order that we may have pasture or meadow, that grass be sown so as to give a crop the first year. When

it is required for pasture, seed with rye, as recommended in another chapter. If for hay, clean land should be selected and put in order for seeding early in September, for the grass should get a good start in the fall to enable it to endure the winter, and also that it may get the start of weeds. It will pay to top-dress with fine manure, if it is available, and, if not, with bone-meal, which is a special manure for grass. I have found that timothy does much better sown in fall than in spring, as it roots deep enough to enable it to withstand drought, which, if sown in spring, would be fatal to it. It is sometimes desirable to reseed old pastures without plowing them or losing the pasturing for a season, and I find this can be done by harrowing until the surface is a little scarified and sowing in the fall. If the land is quite bare, I would recommend rye to be sown with the grass, as it will catch when sown on the surface if it is slightly mellowed, and will not only protect the young grass, but also furnish early feed.

Bare spots in pastures not only give no income, but are unsightly, and they should be top-dressed with fertilizers of some kind, and re-seeded.

I believe it wise to use the larger part of the manure made on the farm with reference to its effect on the grass crop. Where this can be done (as recommended in other chapters) so as to secure the benefit of the manure for a grain crop, and at the same time have it fertilize the grass, this is probably the wisest use that can be made of it; but, when a grass-field is to be plowed for corn, if manure can be had to top-dress it a year beforehand, it will cause the roots to multiply in the soil and the sward to thicken up, so as to furnish as great, or a greater, amount of plant food for the corn, and give in addition a very heavy grass crop.

In 1883 I saw on the farm of a neighbor a good illustration of the value of manure for grass. A field of ten and a half acres was liberally top-dressed with good barn-yard manure, and it produced at two cuttings fifty-six loads of hay. Eight of these loads were weighed, and averaged twenty-one hundred pounds to the load; and, taking these as an average, the field

yielded at the two cuttings over five and a quarter tons to the acre.* Chemical analysis shows, also, that hay grown on land well fertilized is of a much greater feeding value than that grown on a poor soil.

A dressing of manure on permanent pastures will not only give one or two largely increased crops, but will make the pasture better for many years. I have passed daily, for several years, some pasture lots which have been heavily top-dressed with manure, and they carry fully double the stock per acre that the ordinary pastures of the same neighborhood do, and endure drought better.

While pastures should not be overstocked, it is often a decided advantage to have them eaten short, as many varieties of grass become dry and of little value if allowed to go to seed. It is wise, therefore, to have the pasture divided so as to enable the farmer to concentrate the stock on one field while another is growing up. This changing of the stock is of advantage both to them and to the pasture.

Hay Making.—I doubt if in any farm operation there is so little judgment exercised as in hay making, or if on any other point a little scientific knowledge would be of so great value. The practice of a majority of the farmers of my acquaintance is to allow their grass to stand till ripe, often so that the seed shatters in handling it. Chemical analysis shows that the changes the plant undergoes in maturing the seed, greatly reduces the value of the grass for food, and careful experiments in feeding confirm this. On this subject Professor Jordan, of the Pennsylvania State College, says: "So far as composition is any indication of value, the hay from early cut grass is more valuable pound for pound than that from late cut grass."

Some experiments made by Professor Jordan in feeding early and late cut hay, confirm this: During the winter of 1881 and 1882, four steers were selected for experiment and two fed on early cut hay for twenty-eight days and the other two on late cut hay for the same period. Then they were changed and for the same period those that had been fed early cut hay were fed

*These two cuttings were made the same year.

on late cut. The result of the fifty-six days' feeding is, given in the following table:

	Early cut Hay. Pounds.	Late cut Hay. Pounds.
Total amount of hay eaten.....	1,696	1,634
Hay eaten per day.....	30.3	29.2
Corn-meal eaten per day.....	12	12
Total gain in weight.....	176	134
Gain of two steers per day.....	3.14	2.4
Gain per lb. of hay fed.....	.104	.082

This gives the relative value of early and late cut hay at :: 100:79.

A second experiment was made, in which a smaller quantity of corn-meal was fed in connection with the hay. This experiment lasted nearly three months, beginning December 1st, and ending February 25th.

	Fed early cut Hay. Pounds.	Fed late cut Hay. Pounds.
Weight of two steers Dec. 1st.....	1,750	1,630
“ “ “ “ Feb. 25th.....	1,922	1,702
Total gain in weight.....	172	72
Total amount of hay eaten.....	2,924	2,234
Corn-meal eaten per day.....	7	7
Gain per lb. of hay fed.....	.059	.032
Gain of two steers per day.....	2	.84

This experiment would show a relative value of early cut to late cut :: 100:55.

These cattle were fed all they would eat clean, and it is noticeable that the two fed on the early cut hay ate 690 pounds more than those fed on that which was cut late. These steers were sold at 6½ cents per pound, which gave a return for the 690 pounds extra of early cut hay, equal to \$18.80 per ton.

Not only does the degree of ripeness, but also the method of curing, affect the quality of the hay. The quicker hay can be cured the better the quality will be, and it is almost as damaging to leave it exposed too long to the hot sun, as to have a rain fall on it. All grasses should be cut when free from external moisture and then cured as rapidly as possible. Under favorable circumstances hay can be cured and put in the barn the same day, and

when this can not be done it is best to put it in cocks so as to protect it from the dew. There is a great difference between good sweet hay cut before the rich juices have turned to woody fiber, and that which has been allowed to get over-ripe, and then allowed to lie for two or three days exposed to dew and burning sun, and the farmer who likes to see his stock comfortable and thrifty, and who expects to find a profit from feeding, will be watchful and vigilant to see that all the work of hay-making is done at the right time and in the best possible manner. The use of hay caps is usually recommended in giving directions about hay-making, but I have serious doubts as to whether they would pay. If the rain is heavy and long-continued the hay will be wet from the ground, and the heat and moisture from the cock will gather under the cap and damage the top. Besides, our summer showers usually come up so suddenly that it would be impossible to cover a field of hay in time to protect it. Barracks similar to those described in our chapter on wheat, will be found profitable on farms where hay is grown as a leading crop, and for this purpose they can be built cheaply by setting posts of lasting wood in the ground to support the roof. When hay is to be stacked or put in barracks in the field, much time and labor in handling can be saved by the use of the "twenty-foot hay rake," which you will find described and illustrated in the chapter on "Handy things."

Since the introduction of the self-binders for wheat, I have heard of some farmers cutting the timothy hay with these machines. I believe that it would cure out in the shock as well as wheat, and would be very little damaged by rain, and I would recommend that farmer's owning these machines try this plan.

Shrinkage of Hay in Barn.—It is a question of considerable interest to the farmer who sells hay, to know what the shrinkage will be between the time it is stored and the following winter or spring when it has thoroughly dried out.

I have before me the results of seventeen trials made at the Pennsylvania State College Farm. The experiments extended over a space of three years, 1879–81, and included timothy and clover, and the cutting was made at different stages of growth

from the time the grass began to head, until it was nearly dead. In all of these trials but three, about two tons was put in a lot. In the three eight hundred pounds each. The greatest shrinkage was 36 per cent, and in four cases it exceeded 30 per cent. The smallest was 12 per cent, on clover nearly dead, and in five cases it was less than twenty per cent. The average for the seventeen trials was 24.1 per cent. The second weighing was made in December or at a later period during the winter. From these experiments it will be seen that it will require a large advance in price to pay for the shrinkage and rehandling of hay.

Millet.—The millet family is better for green feeding than for hay, but as it will make the best crop when sown about the first of June, and the yield of hay from our meadows can be estimated closely by that date, it is often wise for the farmer to sow a field in millet when he finds the hay crop likely to be short. If the crop is to be grown for seed, not more than twelve quarts of seed should be sown to the acre. If for hay, from sixteen to twenty quarts. The yield is often very heavy, and the quality is fair. For fodder it should be cut before ripening. It does best on loamy land, but will produce a crop on any good soil. Great pains must be taken in the preparation of the seed bed, as when it is sown at the hot season of the year the land soon dries out, making it difficult to get a stand, and if the millet is thin on the ground it will be coarse and inferior as food, and likely to be mixed with weeds. In preparing land for millet I would recommend that it be rolled as fast as plowed, then harrowed fine and the seed sown and covered with the plank drag. It will make a better start if sown soon after a rain, than if sown before one heavy enough to crust the land, particularly on a clay upland. The hay is better for cattle than horses, and it is thought to be unwholesome for the latter if the seed is near maturity.

Clover.—I have, in a previous chapter, spoken of clover as a renovator and cleanser of the soil, and here I shall speak more particularly of it as a food-producing plant. While the varieties are numerous, there are but few which are of sufficient value to the farmer to justify the devoting of our space

to them. These are the "Common Red," of which we have two varieties, the larger of which is called the "Sapling," and also "Large English," and in Europe goes by the name of "Cow Grass." The "White," or "Dutch," the "Alsike," and "Alfalfa," or "Lucerne." The common red and white need no description, as they are familiar to all. The "Sapling" is of larger and coarser growth than the common red, and some weeks later in ripening, which makes it valuable to sow for hay with timothy, as it will be ready to cut with the latter grass, and will not only be supported during its growth by it and prevented from lodging, but can be much more easily cured. It also grows finer when mixed with timothy. It makes a wonderful growth and is, I think, of much greater value for fertilizing purposes than the common red, and so far as my experience goes, makes as good pasture. The heaviest crops of hay we have ever cut on "East View Farm," were when we had sown two or three pounds of this mammoth clover seed with the timothy. I think that the hay from this variety of clover is more easily cured than from the common red, one reason being that it is not so sappy, and another that, being cut later, the weather is usually hotter and better for curing. I have found that it is relished by the stock as well and eaten with as little waste. The sapling clover seeds in the first crop, and does not make a heavy second growth like the common red. I would advise every farmer to give it a trial, but as it might not succeed as well on all soils as on our limestone, it would be prudent to experiment with a single field for a year or two before substituting it entirely.

Alsike clover is an intermediate variety between the white and common red. It grows nearly as tall as the latter, with a much finer stem and foliage, and has a pale red or pinkish blossom. It is a perennial, extremely hardy, and will yield good crops for eight or ten years. It branches very heavily, and throws out many stalks from one root, and so requires but thin seeding; the roots strike very deeply into the subsoil. The period of bloom is much longer than with red clover, and it will be ready to cut with timothy. Only half as much seed will be required as of red clover, and it may be sown either spring or fall.

It bears its seed in the first crop. It yields a fair crop of hay or pasture, and is in great favor with bee keepers, as, like the white clover, bees can work it, while they can not reach the sweets in the common red clover.

Lucern, or alfalfa, is largely cultivated in some countries to supply green food for cattle. It is not valuable for hay, as it becomes very woody and fibrous as it matures, and should be cut for green food before it comes into blossom. It will bear several crops in a season, and produce a large amount of succulent food. It does not succeed on wet soil or tenacious clays, but is specially adapted to warm, sandy soils, and to hot climates as its long roots enable it to withstand drought. It is largely grown in Peru, under the heat of a tropical sun, and is esteemed a valuable plant in California and the South. As it is very sensitive to weeds, it is best to sow in drills and hoe the first season, till it becomes well established, and top dress each fall with well-rotted manure. When once well established, it will yield bountiful crops for many years.

White clover is rarely sown as a farm crop, but seems to be indigenous to many soils, and comes in of itself along the roadsides, pastures, and meadows. I was much troubled with it in my strawberry beds many years ago, when engaged in market gardening, and was puzzled to know how the seed came there, as I was sure that I had not taken it in the manure. A study of the habits of the plant showed how the seed was disseminated. The white clover, unlike the red, seeds in the first crop, and the seed is not inclosed in a tight hull, but shatters readily. As the head ripens half the spikes or flowerets turn down, and when ripe the stem becomes brittle and the head breaks off, and is nearly as round as a ball, and is rolled along by the wind, scattering its seed as it goes. The seed of white clover possesses great vitality, and will remain for many years in the soil, and then grow when the conditions are favorable. By dressing old meadows with ashes, a heavy crop of white clover will often result, although none has grown on the field for a generation. I think that on soils where white clover flourishes it would be profitable in seeding permanent pastures to use a pound or two of it per

acre in the mixture, as it will fill the vacancies and protect the soil, and also furnish a large amount of sweet and nutritious food.

As red clover is the variety of universal growth and greatest value to the farmer, I shall confine myself to it in the remainder of this chapter. I place a very high value on clover, and believe that it ranks in value and importance with our leading grain crops. My reasons for this are: 1st. Because of the large amount of food it furnishes at small expense. 2d. Because of the value of the manure made from it. 3d. It can be produced not only without reducing the fertility of the soil, but on the contrary, the field which has grown a crop of clover has a larger supply of available plant food, and is improved in its mechanical condition. 4th. It is a cleansing crop, by which I mean that we have much less trouble with weeds, when cultivating a field that has been in clover than when one grain crop follows another.

In estimating the profit of a crop, we can not be governed entirely by its cash market value, but must take into consideration, 1st. The cost of producing and getting it into market, and, 2d The condition of the soil after the crop has been removed, and its capacity to grow a succeeding crop. Tried by these standards, clover compares favorably with any crop of the farm. While it is difficult, if not impossible, to estimate accurately the fertility, either removed from or added to the soil, we may, perhaps, approximate it, and I give the following as what I believe to be a fair estimate:

I should not expect to keep a field at average fertility if continuously cultivated in grain without the addition of manure, and if the field was dressed once in five years with fifteen loads of manure, worth one dollar a load, it would average three dollars a year per acre; and this seems to me to fairly represent on average soils the reduction of fertility by a grain crop. On the other hand, I have rarely failed to get an increase of grain when following clover ranging from five to twelve or fifteen dollars in value per acre, and, even taking the lowest estimate, it would give a difference of eight dollars per acre in the condition of the soil in favor of the clover crop; and this estimate

I make on the supposition that both crops are removed from the soil. The feeding value of a clover crop depends on so many circumstances that we can not lay down any fixed rules in determining it. We can, however, get an approximate idea of its worth. Mr. Coburn, in his work on *Swine Husbandry*, estimates that an acre of clover fed to hogs will produce one-half more pork than an average acre of corn. He claims that fifteen pounds of green clover will make a pound of pork, and that an acre of good average clover will produce six tons green, and foots up a feeding value of thirty-two dollars for it. While I would not dispute that, under favorable circumstances, this might be realized from it, yet I know that the estimate is more than double what we could expect as an average result. Mr. L. N. Bonham, who has a bottom farm, and follows a rotation which gives a clover-field of about thirty acres each year, has made the feeding value of clover a matter of careful study, and puts the average pasture value at nine dollars per acre. I consider this a safe and moderate estimate, and think that the clover crop will compare favorably with our grain crops on this basis. I should call eight dollars per acre a low estimate for the cost of growing and harvesting an acre of corn or wheat; and, if we add to this the three dollars which we have estimated the soil is reduced in fertility, it will make eleven dollars to be deducted from the grain crop in making up our balance-sheet to find out what the profit is. We deduct from the clover crop only one dollar per acre as the expense of seeding; but, on the other hand, credit it with the value of fertilizing elements developed in the soil.

When the crop is cut for hay and seed it often proves very profitable, especially near a city or village market, as clover-hay is considered superior food for milch cows, producing yellow butter in winter. When the second crop is to be cut for seed it is important to cut the first crop early, and I would advise cutting as soon as the earliest blossoms have turned brown. It will be harder to cure than if cut later, but will contain less indigestible woody fiber, and the seed crop will be heavier.

The nutritive value of clover hay, if cut at the right season

and well cured, is fully equal to that of timothy, and in some combinations it is even more valuable, on account of the larger proportion of albuminoids it contains, but is not considered so good for horses as for cattle.

When hay is the main object from clover it will pay to sow grass with it. If the large English clover is sown, timothy is the best, and I recommend that not less than double the amount of timothy seed be used that you do of clover, or the latter will entirely smother out the timothy for the first season. If the common red clover is sown, orchard-grass will give the best satisfaction, as it ripens with the clover. Clover hay is more damaged if wet when partially dried than the grasses, and also by being overdried, for in either case the leaves will crumble and fall off. The best plan is to cut clover in the afternoon, and not disturb it till the next day, after the dew has dried and the top wilted; then turn and dry as rapidly as possible, and get it into the barn if it will do; if not, put in small cocks, and open the next day. If the farmer has a supply of old hay or bright straw, and will put a layer of this in the mow every eighteen inches or two feet, the clover may be put in safely with much less curing than if put by itself, as the moisture will be absorbed so as to prevent its taking harm.

A method of curing clover-hay by its own heat is coming into practice with some of our best farmers. The conditions of success in this method are that it should be entirely free from external moisture, and that it be packed into the mow as solid as possible. The clover is cut after the dew is thoroughly dried off in the morning, and allowed to wilt, and by two o'clock it is ready to draw to the barn; at the first appearance of dampness in the afternoon the work should be stopped. If more hay is cut than can be taken to the barn it should be cocked up, and these cocks should not be opened the next day till the outside is thoroughly dry, and then two hours' sun will be sufficient for them. When a mow is filled in this way the moisture will gather at the top and spoil a little of the hay, but the bulk of the mow will be found sweet and bright, and of the best quality.

Clover-hay can not be kept in the stack without damage,

unless some better material is used to top out, and those who expect to use much of it should provide barracks for it if they have not barn room. Salt as it is put into the mow, as it will render it more palatable to the stock. Over-salting is injurious, and I would recommend not more than one gallon to the ton.

Time to Sow.—As a rule, I think the best results will be had from early seeding—say about the first half of March. If, however, the farmer sows his seed in the chaff, as is the custom with many, it may be sown in February, as the seed, when inclosed in the hull, does not germinate so soon, and the young germ is somewhat protected. If the farmer will harrow his wheat, so as to loosen the surface a little, the seeding can be safely postponed to a later date, and any time the first half of April is seasonable. When seeding with spring grain smooth off the field with the plank-drag (a cut of which you will find in the chapter on corn) before sowing, and, unless a rain falls within two or three days, run over the field again with the drag. I am seeding more heavily of late years than formerly, as I am convinced that it is profitable. The testimony of a man who was for many years in charge of a clover-hulling machine is that the heaviest yields of seed are where the land was seeded at the rate of ten pounds to the acre, and I think this none too much, but, on fresh, loose land, or that which had been well top-dressed with manure, I should expect a good stand from a less quantity of seed. When the land is not to be harrowed I prefer to sow on frozen ground, on a clear morning, when there is likely to be a thaw, as this settles the seed and covers it, so that it is not likely to be washed into bunches by a rain.

It would be of great advantage if clover could be sown in the corn with a certainty of getting a stand, and this is often done. My own experience, however, has not been favorable to this method, as I have found that I often failed to get a stand. Other farmers have been more successful, and it would be so great an advantage to be able to seed our corn fields with clover, that I would advise every farmer to try experiments to ascertain the best time and manner of seeding in the corn-field. I would try sowing in July when the corn was worked the last time, and also

about the first of September. It is certain that there are soils or seasons that give excellent results for summer or fall seeding of clover, and if an acre or two of the corn-field was sown each year at different times, and the experiment repeated for several years, it would not be long till the farmer would learn the conditions necessary to success.

As a rule, farmers turn their stock on the clover too soon after harvest, and by so doing they not only permanently injure the crop, but also fail to get the benefit from the fall feed which they would if they would allow it to make more growth. The same rule holds good as with spring pasturing. It should not be pastured, at least heavily, until the blossom buds show. In favorable autumns clover will grow large enough after harvest to make a heavy crop of hay, and will also mature seed. I have known nearly two tons of hay cut to the acre, or a bushel of seed, from the growth after a wheat crop. If it is the intention to follow with corn the following spring, I would advise that the clover be allowed to make all the growth it will and neither be pastured or mowed; but if it is to stand over it is not safe to leave this mass of foliage on the soil, as it will in some cases kill out the entire crop. I had in the fall of 1882 thirty acres of heavy clover, and allowed the stock to partially pasture all of it but five acres. The pastured part came through the winter in fine condition, while the part on which the fall growth was left was entirely dead the next spring. It was not winter-killed, for there was such a mass on the ground that it could scarcely freeze at all, but was either smothered or killed by field mice. I did not at the time make a careful examination to determine the cause, but as I noticed a number of owls all winter near the field I am inclined to suspect that the mice caused the trouble. I have been told by farmers who have wintered heavy clover without pasturing or mowing, that it is quite common for field mice to greatly damage the crop.

Clover for Pasture.—I consider clover as only a supplementary pasture crop, by which I mean that the farmer never should depend on it entirely. We have grasses that are less injured by tramping or close feeding, which will enable the

farmer to turn his stock out more than a month earlier than clover ought to be pastured. It is especially damaging to allow stock to run on clover while there are frosts in spring, as every plant that is touched when frozen is killed. If the clover is allowed to grow until it begins to blossom before stock is turned on it, the roots have pushed down deeply into the soil, and the land is so densely shaded that it will take a very severe drought to affect it at all; and when the grasses are drying up and their growth is entirely stopped, the clover will still grow and furnish an abundant supply of food.

Fertilizers for Clover.—As clover is always sown with a grain crop, manure is seldom if ever applied with reference to the growth of the clover, but I have shown that when the manure is applied at the surface and finely pulverized, it will greatly benefit the clover as well as the grain. I consider this a strong argument in favor of using the manure as a top dressing on small grain, and also for thoroughly pulverizing it. Gypsum or land plaster is considered a valuable fertilizer for clover, and particularly to give the second crop a start when it is to be cut for seed. The plaster should be applied when the dew is on in the morning or on a damp day. Two hundred pounds per acre is sufficient. "Harris" in his *Talks on Manures* says: "The effect of a top dressing of gypsum on clover was often wonderful. The crop was larger and more luxuriant, and this extra growth was caused by the small dressing of powdered gypsum rock."

Growing Clover Seed.—The yield of clover-seed varies from one to seven bushels per acre, and three bushels is about a fair average. In one important particular, clover differs from most other plants, which is, that it produces a better effect on the soil when allowed to ripen its seed than when removed in the green state either by mowing or pasturing.

In investigating to find the reason of this it has been found, that the greatest development of roots in the soil is during the period of the growth of the second crop. In an experiment by "Dr. Augustus Voelcker" it was estimated that an acre of clover contained after cutting for hay in round numbers

1,500 pounds of dried roots. In November following, after the field had produced a crop of seed, further careful experiments showed 3,600 pounds to the acre.

Taking, then, the improvement in soil, the crop of hay, and the seed, a clover crop will often prove more profitable than a grain crop. The seed crop should not be allowed to stand too long, or much of it will be lost by the heads breaking off. It should be left by the reaper in bunches large enough for a good forkfull; and the less it is handled the better, as each handling causes waste. The better plan is to thresh from the field, as it can not be stacked so as to shed water, and is so dusty as to be very unpleasant to handle in the barn. I think it will pay many farmers who do not grow it as a money crop to grow their own seed. A few acres can be grown and tramped off with horses, and sown in the chaff. I have never had a better stand than when I have sown in this way.

I think it advisable for farmers to grow their own seed, not only for the sake of economy, but from the fact that often the seed bought contains the seeds of troublesome weeds which will prove a pest to the farm, or it may be old and worthless. I can not tell how long clover-seed retains its vitality, but dear-bought experience leads me to advise farmers not to sow old seed. I think old seed can usually be distinguished from new by its color, the new seed appearing bright and glossy, while the old has a dull appearance. Often old seed will be mixed with new, or the seed may be adulterated with sand or stone, ground and sifted to the size of clover seed. These mixtures and adulterations are difficult to detect with the naked eye, but by the aid of a small magnifying glass they can easily be seen. I would advise the farmer to always carry with him one of these small glasses. I prefer the kind called linen glass or linen tester, as they are made with hinges to fold flat and when closed one of them occupies but little more room than a nickel, and can be carried in the purse or vest pocket. The magnifying power of this glass is sufficient to make a clover seed look as large as a pea, and will readily indicate whether the seed is mixed or adulterated.

Hoven, or Clover Bloat, and Slobbers.—These are both produced by clover, and the former sometimes becomes a serious matter, as it is often fatal, and sometimes in a very short time. I have known a cow to be milked and turned out early in the morning perfectly well, and to be found dead, from this cause, before 9 o'clock. I shall not speak of the treatment to relieve this, as that will be found in our veterinary department, but will mention what I believe to be preventives. Hoven is caused by fermentation instead of digestion of the green food in the stomach, and is due to eating too large a quantity, often imperfectly masticated, and is most liable to occur when this is taken into the stomach early in the morning, when the clover is covered with dew or frost. The danger will be greatly lessened if the farmer has early pastures for the cattle to run on, so as to become accustomed to green food before being turned on the clover. When you first turn on the pasture, do so in the afternoon of a clear day, when the clover is warm. A straw stack in the field, or a little hay fed in the morning is also said to be a preventive. The risk from this cause is certainly small, for I have had more or less clover on my farm every year, and have not lost an animal in thirty-five years, and have known of but few cases among my neighbors. This leads me to think that mixed pasture is a preventive, for while all of our farmers sow clover, most of them sow timothy or orchard grass with it, or have permanent pastures to turn on early.

What is commonly called slobbers, is in reality a salivation, somewhat similar to that produced by calomel. Cattle are not affected by it, and horses from the second crop only. It is said to be caused by an acid which is developed in the late growth of the clover, particularly after the cool nights arrest the rapid growth. While this can not be classed as a disease, it does reduce the strength and flesh of the horse, and work horses should not be allowed to run on clover after it reaches the stage at which this effect is produced.

CHAPTER VII.

CORN.

THE corn crop of the United States exceeds one thousand million bushels a year. The mind can not comprehend the vastness of these figures, but, perhaps, by looking at the matter in detail, we can get some idea of it. It amounts to about twenty bushels for each man and woman and child in the nation. It would load thirty million wagons, with thirty-three and a half bushels each, and these wagons arranged in a procession one hundred to the mile, would encircle the globe twelve times. If loaded on cars, four hundred bushels to a car, it would take two and a half million cars to transport it, or sixty-two thousand five hundred trains, of forty cars each, and these trains, one mile apart, would encircle the globe two and a half times.

The average yield per acre in the United States, for the eleven years, from 1871 to 1881, inclusive, was twenty-six bushels. The center of production has been for years moving westward, and may finally cross the Mississippi River. The largest yield per acre is found in the New England States, and is accounted for by the fact that the acreage is small and the crop manured and cultivated like a garden. Ohio has long ranked high as a corn-producing State, and during the last thirty years its averages have twice reached forty bushels per acre, and eight times fallen below thirty bushels. Our smallest yield since 1850 was in 1854, when the average was twenty-six bushels per acre, and the heaviest in 1872, when it was nearly forty-one bushels, and the average for the entire period of thirty-one years is nearly thirty-four bushels. I fully believe that by the adoption of a system of rotation that would give

a clover sod on which to plant corn, by keeping more stock and saving more manure, and by the more thorough preparation of the soil, and cultivation of the crop, we might easily increase this average one-half, and possibly it might be doubled.

In the chapter on "Farm Management," I show the difference in the cost per bushel between a light and heavy yield of this crop. In the spring of 1877, when conducting the agricultural department of the *Cincinnati Enquirer*, I offered several premiums for the largest yields of corn. We organized what we called "The Hundred Bushel Club," consisting of about seventy members, and I here give in full the reports of nearly a score of them:

MUNCIE, IND., November 2, 1877.

The following is a report of my one-hundred-bushel acre of corn: It was black burr-oak land; it was a very stiff blue-grass sod. I plowed it in April, and planted it in choice white corn on the 7th of May. Plowed it five times. Just cultivated it the same as the balance of my crop (ninety-five acres). Did not hoe, use any manure, or any thing else but the common two-horse cultivator. Now for the result: The first "choice acre" made 102 bushels; the second made 98 bushels; the entire field averaged $78\frac{1}{2}$ bushels.

GEORGE NISWANGER.

MILLGROVE, BLACKFORD COUNTY, IND., }
November 3, 1877. }

I, to-day, have gathered my "Club acre," which yielded 98 bushels and 31 pounds. The variety of corn planted was the Martin yellow. It was planted on new, black, loamy soil, it being the second crop, and planted May 16. Breaking the ground, \$1.50; harrowing and rolling, \$1; furrowing and planting, \$1; plowing five times, \$3; husking and cribbing, \$3; total, \$9.50. The greatest yield from a single grain was two ears from one stalk, which yielded 2,326 grains, and weighed one pound and ten ounces shelled corn. I have selected a bushel of ears of the Martin yellow field-corn which just took fifty-nine ears to make the bushel, or seventy pounds.

HENRY S. McFERRIN.

GIBSONBURG, SANDUSKY COUNTY, O., }
November 26, 1877. }

The following is the report of my choice acre of corn, grown on black, sandy land, clover and timothy sod: I plowed it the 1st of May with the Oliver chilled plow, from ten to twelve inches deep; harrowed twice. Planted on the 17th of May with a one-horse drill, $3\frac{1}{2}$ feet apart. Cultivated as follows: Harrowed the corn with two-horse harrow once; plowed with double-shovel plow twice; did not hoe; used no manure. Now for the result:

Weighed 7,339 pounds, being 104 bushels 59 pounds, of corn; shelled 70 pounds of ears; made $58\frac{1}{2}$ pounds of shelled corn. The expenses are as follows: Plowing land, \$1.50; harrowing, 50 cents; planting with drill, 25 cents; harrowing the corn, 25 cents; plowing corn twice, \$1; husking and cribbing, \$5; total, \$8.50.

BLUE RIDGE, IND., November 27, 1877.

The following is a report of my acre of corn: Yield, 91 bushels; variety of corn planted, mammoth white; variety of soil, black loam. First crop. Plowing, \$2; harrowing, \$1; crossing off and planting, \$1; plowing three times with double-shovel, \$2; husking and cribbing, \$4.50; total, \$8.50. We have selected fifty-three ears that weigh seventy-one pounds.

R. A. BURTON.

WHITEWATER, WAYNE COUNTY, IND., }
November, 27, 1877. }

I send the result of my acre to the club. I selected my acre out of a five-acre piece of rich sand loam, black burr-oak bottom; broke on the 5th of May; harrowed and rolled; then took one of Ag's top-draws over it; marked off, with three-runner sled, three and one-half feet each way; planted eighth day of May with hand-planter, three and four grains to the hill, of the Excelsior Kansas corn; rolled soon as corn was up; plowed once each way with small shovel, then each way with large shovel, using the Western two-horse cultivator; plowed close two first times; whole five acres plowed alike, only the one acre I followed with the hoe first and fourth time, then finished clearing it second week in July. Laid by plowing 28th June; plowed four times, hoed twice, and cleaned up. I husked the first week in November four loads of corn, weighing 26 bushels 10 pounds per load, 70 pounds per bushel, making 104 bushels. I shelled one barrel of 2 bushels 10 pounds, making 2 bushels $1\frac{1}{2}$ gallons strong measure; then weighed the shelled, 2 bushels 19 pounds of 56 pounds standard. This will bring me up to about 107 bushels, which is 10 short of what I expected. Expenses as follows: Half day plowing, \$1.25; harrowing, rolling, and dragging, \$1.25; marking, 50 cents; seed, 25 cents; hoeing and cleaning, \$1.50; plowing four times, \$2; husking and cribbing, \$2.25. Total, \$8.90.

J. S. LONG.

WILLIAMSPORT, PICKAWAY COUNTY, O., }
November 23, 1877. }

I am now prepared to give you a full report of my one acre of corn. The acre of land used was a part of a pond which had remained idle for a number of years, filled with water almost the year round. It was ditched last spring, just before plowing, which I did the 1st of May. I planted the 14th of May, in rows three feet seven inches wide, and twenty-one inches in the row, the variety known as the Kentucky, being white, large ears, deep grains, and comparatively small cob. The seed used did n't come up as well

as it should, and the 1st of July I had a very irregular stand; also a little dry at the time it was earing. I plowed it four times, and went through with the hoe twice, but didn't draw any earth to the corn. I cut it the 1st of October, and finished shucking the 14th of November 110 bushels and 56 pounds. The least number of ears to the bushel was 52; actual cost of labor performed on the acre, \$9.60, or eight cents to the bushel. I think, if all things had been favorable, I should have had at least fifteen bushels more corn. And now, in conclusion, I would say that the experiment has been worth the effort and all the labor performed, and has taught me that it pays to underdrain, to plow deep and pulverize well before planting; and if we, as farmers, were more careful in this particular, the average yield per acre of corn would be raised far above what statistics have shown.

H. A. MILLER.

MORRISTOWN, IND., November 23, 1877.

I herewith send report of my premium acre of corn: 8 cords stable manure at \$1, \$8; hauling and spreading same, \$6; breaking and pulverizing, \$2.50; seed, 25c. and planting 50c.; $4\frac{1}{2}$ bush. salt, 30c. (sown broadcast), \$1.35; cultivation, \$2; harvesting 88 bush. at 3c., \$2.64; interest on land at 10 per cent, \$7; total, \$30.24. Credit by 88 bush. corn at 30c., \$26.40. credit by 1 acre stalks, \$1; total, \$27.40. The soil is a black swamp land of good quality, and has been in cultivation about fifteen years. The planting had to be done a second time. May 18th. Drilled twelve inches in the rows, with the rows three feet apart. Variety of corn, large yellow Dent. Full one-fourth of the stalks failed to produce any thing. I think it was planted too late and too thickly. Cultivation first and second times with a one-horse harrow; third time with a small tooth cultivator, and fourth with a double shovel. A glance at the figures is sufficient to satisfy any one that the experiment was a failure financially, but perhaps the few remaining dollars are saved in experience.

J. C. DAVIS.

ELLSWORTH, ILL., November 24, 1877.

I have husked my premium acre, and have for my pains 118 bushels, 33 pounds of as good corn as I ever raised. The land on which my corn grew has been in cultivation since the year 1853, has never had any manure of any kind on it, and I had thirty-five acres to tend with one team. I first plowed my land from four to five inches in depth; I then harrowed it once, marked it off three feet, nine inches, and planted the same distance; I then plowed it three times. This was all the attention my corn received, the entire piece receiving the same attention. On the 7th of November I measured the acre. 10 by 16 from east to west, the length; the width from north to south. I went into the entire piece, and from it selected the best acre, as I thought. Then on the 12th I husked and weighed it in baskets. The corn is of the variety known as the Kickapoo Beauty, a corn peculiar to this locality.

The entire cost of production and gathering for the acre is \$8.60. We averaged the piece at eighty-five bushels. My premium bushel of the same variety took sixty-one ears. This was thoroughly dried by artificial heat, heat, and weighed to-day, November 24th. If necessary, all the above will be certified to when required.

GEORGE L. HOOVER.

BLOOMINGTON, CLINTON COUNTY, O., }
November 24, 1877. }

I send you the result of my premium acre of corn, gathered the 21st and 22d of this month. The acre was measured and weighed by two disinterested men—named J. P. Delaplane and J. M. Earley. The land is sugar-tree, laying open to the south; the first crop, a timothy sod; no manure; cultivated with a double-shovel plow; sufficient harrowing before the corn was planted; plowed three times; drilled the 18th of May; a large yellow corn called the Leaming; weighed out one hundred and six bushels, allowing seventy pounds to the bushel.

JONAS SPEARS.

P. P. DELAPLANE, J. M. EARLEY, witnesses.

NEW LANCASTER, TIPTON, COUNTY, IND., }
November 20, 1877. }

The following is a report of my one hundred bushel acre of corn: It was black walnut land, and a very stiff red-top sod of eleven years' standing. I broke it in March, and planted it the 1st of May with a Hoosier drill, twenty inches apart, with a large speckled corn, a gourd-seed variety; harrowed once; hoed once; plowed five times; no manure. Now for the result: My choice acre made 110 bushels and 33 pounds; the second 105 bushels and 13 pounds. The ground and corn were measured by H. Lamb, C. Vanness, and myself. Now for the expenses: Breaking, \$1.50; three times harrowing, 50 cents; furrowing and planting, \$1; plowing five times, \$2.50; husking and cribbing, \$2.50; hoeing once, \$1.50; total, \$9.50.

WILLIAM LAMM.

COLES COUNTY, ILL., November 26, 1877.

The undersigned respectfully reports the following concerning his club acre of corn. The land on which it grew is timber land, and has been in cultivation eleven years. The soil is black walnut land, underdrained with three-inch tile two and a half feet under ground, and runs very near through the center of said club acre. The land has been in corn five seasons, and the balance of the time in small grain and clover pasture; has never been manured; was sown in rye and clover in 1875, and was pastured with cattle and hogs, rye and all, until it was planted in corn last spring; allowed no stock to roam over in the latter part of winter and spring when the ground was soft. The ground was broken about six inches deep the latter part of April and put in as fine condition for planting as the harrow and roller could make it. It was laid off with a marker three feet, nine inches apart, was drilled

with a one-horse drill, sixteen inches apart, on the second day of May. The seed was yellow dent, and was as sound as seed-corn can be, came up well, was plowed with double-shovel May 11th and hoed May 12th, plowed with two-horse cultivator May 23d, June 11th and June 23d, and hoed again July 7th. All the extra labor that was performed on this acre was more care in doing the work and one additional hoeing. This made the expense of raising it only a trifle more than of ordinary cultivation, and the results about twenty bushels of good corn more. We had one drawback in the shape of a big storm about the middle of August, which damaged it to the extent of from fifteen to twenty-five bushels; at least, that was the estimate put upon it by the man who helped to gather it.

Respectfully,

GEO. BIDDLE.

[The product of this acre, as certified by two persons, was eighty-two bushels and ten pounds.]

ELLSWORTH, McLEAN COUNTY, ILL., }
November 23, 1877. }

My club acre of corn weighed on Fairbanks scales, net, 7,075 pounds. Taking 70 pounds for a bushel, there would be 101 bushels and 5 pounds. I husked and weighed on the 13th and 15th inst. The variety was the yellow Dent. The land is prairie bottom, and been in cultivation but three seasons only. Depth of soil 18 inches, light and sandy loam, and black as the "ace of spades." It was broken up to the depth of ten inches on Saturday, the 26th of May last, and immediately afterward harrowed level and planted on the following Monday (the 28th), using the common two-horse planter, making the rows 3 feet 8 inches wide, and dropping the hills 2 feet 7 inches apart; had an average of two stalks to the hill. As soon as planted I rolled the ground, and as soon as the corn was two inches high I began to work it with the "Bloomington two-horse double-shovel cultivator." I gave it three plowings with this, and "laid it by" with a one-horse "Barshare plow;" I cultivated through "one way," as it is called. I made use of no fertilizers or manure of any kind. I had three and one-half acres in this strip of land, and gave it all the same attention, and the result was 310 bushels. Now, the cost of my one acre was: For breaking up with two horses and hand, \$1; harrowing, 50 cents; seed, 20 cents; planting, 50 cents; rolling, 25 cents; plowing three times with cultivator, \$1.50; plowing once with Barshare, 50 cents; harvesting, at $2\frac{1}{2}$ cents per bushel, \$2.52 $\frac{1}{2}$; total cost, \$6.97 $\frac{1}{2}$.

David E. Arrowsmith, surveyor; Willard C. Banks, weigher; W. W. Harsha, witness to gathering and weighing.

DANIEL ARROWSMITH.

P. S.—Largest production from single grain, one large stalk and sucker stocks bearing three ears and one "nubbin," weight 2 pounds $1\frac{1}{2}$ ounces, cob and corn.

D. A.

LEXINGTON, SCOTT COUNTY, IND., December 5, 1877.

I now report for publication my success as a competitor for the prizes offered to farmers. In my effort to raise one hundred bushels of corn on an acre of land: Corn planted on the 17th day of May, on land that had been in corn two seasons previous—bottom land, sandy loam soil; rows, three and a half feet apart; hills, two and a half feet apart; two stalks in a hill; seed, common white corn, yellow cob and deep, long grain; cobs weighing only ten pounds two ounces to the bushel; corn gathered and weighed in the ear on the 19th of November, making ninety-one bushels and a fraction.

SOLON T. HARDY.

FOREST HILL, DECATUR COUNTY, IND., }
December 1, 1877. }

I make a report of one acre of corn cultivated this season. My ground was sandy. I drilled three feet seven inches apart, grains one foot apart, and gave four plowings, with a common double-shovel plow. It was somewhat injured in our August drought, but made a yield of eighty-eight and one-half bushels, and of the same forty-seven ears weighed just seventy-one pounds. It was planted May 10th.

H. J. POWNER.

WEST RUSHVILLE, FAIRFIELD COUNTY, O., }
November 26, 1877. }

Having gathered my club acre of corn I now report to you. The ground that I selected was a piece of sod, the soil a black loam. I plowed it in March, harrowed it, then rolled it; planted May 9th; furrowed it 3 feet 9 inches each way; planted three stalks in each hill. It made 68½ bushels, allowing 70 pounds to the bushel; plowed it four times with a two-horse cultivator; the cost, \$5 per acre; had seventeen acres in the same field that averaged 60 bushels to the acre.

WILLIAM EYMAN.

CANTON, OHIO, December 5, 1877.

There being so very few reports yet from members of the Corn Club, I am afraid there will be some who, through failure to realize the 100 bushels, will not deem a report of any consequence, and we shall not hear from them. I have no doubt there are more of us who have realized under 100 bushels than who reached or exceeded that figure. Probably the same circumstances of soil, and season did not attend any two members of the Club. While members from the southern part of the State, and from the corn producing sections of Indiana, reported favorable growing weather through the months of July and August, we of Northern Ohio had a long and severe drought to encounter. This necessitated us working our corn after it was as high as a horse, to keep the soil loose and mellow, that it might better retain moisture. Here was not only a chance to benefit the corn, but a still better chance to kill the weeds, which always will appear in the cornfield. As a direct result

of this late working I have never, I believe, seen the fields so clean of weeds as they appeared after the corn was harvested. This item alone, I think, has well repaid the extra cultivating required by our dry weather. But we must come to the club acre. Our acre was a clay loam; in wheat the previous season, well set with clover, manured with twelve loads barn-yard manure and plowed about a week before planting-time. Planted May 12th in checks three and a half feet apart each way, and three grains to the hill. Worked four times with shovel plow, and pulled what weeds could not be plowed out. Husked and weighed November 12th. Product, seventy-eight bushels of seventy pounds. Cost of crop as follows: Hauling twelve loads manure, \$3; plowing and harrowing, \$3; marking and planting, \$1; cultivating, \$2; husking seventy-eight bushels, at four cents per bushel, \$3.12; total, \$12.12. On the creditor side we have seventy-eight bushels of corn at fifty cents, worth \$39, leaving a net profit of \$26.88. Variety, pure yellow Dent. We did not cut off and save the fodder of this acre, or we would have \$3.12 to add to the profit, as the fodder when saved will pay for husking. I feel satisfied, had our season at the beginning been more favorable the corn would all have come up, and we would have realized the one hundred bushels, as this acre did not average over two stalks to the hill. However, the yield was high enough above our usual average to pay the entire cost of production.

THEO. KLINKER.

GERMANTOWN, O., December 1, 1877.

I went into the "Hundred Bushel Club" to try what I could do toward increasing the yield of corn, and have been successful, raising a hundred bushels. My acre is rich twin-bottom, two years in clover; no manure. Ground broke in fall, and harrowed last of April, and checked off 4 by $3\frac{1}{2}$; planted 8th of May, covered with hoe; dropped four grains, and thinned to three stalks; then, before corn came up, went over with drag, and after up with Thomas harrow, and after that with double-shovel, using narrow bull-tongue until last plowing. My plan was to cultivate as level as possible; plowed four times; did not give any hoeing, as ground was very clean. Expense of raising, \$5; and here is the result: 105 bushels and 45 pounds. The variety of corn is very large, white, heavy cob, and deep grain; do not know any name for it.

S. LINDEMUTH.

ELMWOOD, MADISON COUNTY, IND., }
December 3, 1877. }

I am ready to report my success as a hundred-bushel corn-grower. The land is a sandy clay soil, having been timbered with mulberry, black walnut, red-bud, sugar-tree, red-elm, burr-oak, blue-ash, and poplar, deadened some five or six years, and attained a pretty good set of blue-grass; was cleared, and having grown three successive corn crops and a crop of oats in 1876, which was a good crop, but, being badly tangled and very stumpy, I pastured with hogs. Then I fed about a thousand bushels of corn to my fat hogs in the fall

and winter on said ground. Plowed the ground in March, \$2; harrowing the last week in April, both ways, \$1; drilling, May 10th, three feet 4 inches wide by twenty inches in the row, 50 cents, with white and red-striped corn, premium of Madison County, a thorough hand-hoeing at about five inches high, \$1; harrowing with two-horse harrow the next week, 50 cents; plowed four times with two-horse cultivator, \$1.25; and one plowing about the 10th of July, with single-shovel, two furrows between each row, 50 cents; husking and cribbing, \$2; total expense, \$8.75. The ground was measured by Henry Yohe, J. F. Stephens, and myself. The corn was weighed in the barrel, with steelyards drawing 162 pounds, by William J. Grover, Louis C. Riley, Henry Yohe, and myself, making 103 bushels and 12 pounds; selecting 64 ears, which weighed 70 pounds. All this is good, honest work.

DANIEL YOHE.

The average yield per acre of the nineteen most successful growers was a fraction over ninety-seven bushels. If you will carefully examine these reports you will see that, in most cases, the corn was planted a little closer than four feet each way, and that there was an unusual amount of work done in the way of harrowing and rolling before the corn was planted. The reports of the cost of growing these crops are imperfect, as some seem to adopt one standard of wages and some another; but, taking them as they are given, they average a little less than nine dollars per acre, and, if we allow five dollars per acre for rent of land, it shows the cost of the corn to be less than fifteen cents per bushel. It will also be noticed that but two of those reporting used manure of any kind, but a majority planted on sod land. In the one case where the grower foots up a loss on his crop, he has charged all the manure (\$14) to the crop, which is obviously unfair, for this manure will benefit several succeeding crops. The facts suggested by these reports show that the adoption of a rotation which would give a clover sod for corn, on which there had been a liberal application of manure for a previous wheat crop, together with thorough preparation of the soil, would often enable us to double the yield of our corn crop.

Seed-corn.—We can not expect a good crop of corn without a good stand, and our chances for a heavy crop are increased if the seed is not only certain to sprout, but also to make a strong growth.

I have for many years believed that we could add twenty per cent to the yield of our corn by attention to the matter of selection of seed. I like the term used by Dr. Sturdevant, "Pedigree seed-corn," and I believe that pedigree is just as valuable in corn as in live stock. The cost of seed-corn is so small per acre that no farmer should take any risk in the matter; but the fact is that, once in every three or four years, a very large per cent of the corn must be replanted from the sole cause that the seed was poor. I think nearly half the farmers in Ohio and adjoining States bought seed-corn in the spring of 1883 at from one to three dollars a bushel, when from one to ten hours' work would have secured for them a full supply of which there would have been no possible doubt. Many farmers learned, also, by dear experience, that it is not safe to plant seed brought from a different climate. Many car-loads of seed-corn were shipped from Kansas and Nebraska, and some from Kentucky, and sold through the Northern States, in the spring of 1883, and it proved to be too late for these localities, and, under the most favorable circumstances, the corn was soft and poor, and in many cases it proved a total failure.

Seed-corn should be gathered early, and thoroughly dried before winter sets in. Many of our best farmers have adopted the plan of putting their seed-corn in their smoke-houses, arranging the ears on slatted racks, so as to give a free circulation of air, and then smoking it until thoroughly cured. I have tried this, and would recommend it, as I never had corn come up stronger, or of a better color. It is claimed that the corn not only grows stronger, but is less liable to be damaged by worms, as the smoke not only fertilizes the young germ, but makes it distasteful to many insects.

My own experience shows that we need not fear injuring seed-corn by too much drying. In the fall of 1882 I put my seed-corn on racks surrounding a stove-pipe, and some of the ears were less than a foot from the pipe, where the temperature all day was so high as to make it uncomfortable to the hand. Toward spring it was suggested by some of the family that, after months of such drying, the germ of that corn must be

killed, but, on testing it, every grain sprouted as thriftily as any corn I ever saw. I believe that every farmer should each year select a small amount of the very finest ears of corn for stock-seed. Plant from them a small field, and from this select the stock-seed for the coming year, and also the seed for the entire crop. I would cut this corn up as green as would be safe, let it partly cure in small shocks, and then husk, and select the seed-corn, and smoke or cure by fire heat before cold weather. The farmer who will adopt this rule, and stick to it, will not only greatly improve his corn, but will avoid the annoyance and loss occasioned by the failure of seed to grow.

Let your seed-corn be saved as it may, I advise testing it a month before planting time. It will be but little trouble, and the satisfaction of knowing when you plant that there is no possible danger of failure is worth ten times the trouble. In the spring of 1883 thirty-five bushels of corn was planted in my neighborhood which would not grow. This was all furnished by one man; and yet the agricultural papers had been sounding the warning all winter that the farmers would have trouble with their seed-corn, as but a very small per cent of the crop of 1882 would grow. This lot of corn, however, was of the growth of 1881, and, supposing that to be perfectly good, no one thought of testing it.

I am convinced that seed-corn grows better if gathered quite green, and cured when it will shrink somewhat, than if allowed to fully ripen on the stalk. I should have dismissed this subject of seed-corn with a paragraph were it not that I see so often that our farmers need "line upon line, and precept upon precept," in this matter.

Professor Blount, of Colorado, who originated the variety of corn which bears his name, is excellent authority on the matter of saving and improving seed-corn. He says: "All seed-corn should be selected in the field, because there, and there only, is it possible to obtain the seed true to name and possessed of the desired characteristics. Only in the field can perfected ears and perfected stalks be found together. Seed-corn should always be picked from those stalks that bear the best ears, and usually

the greatest number of ears, so as to make it more prolific. Seed-corn should always be selected from the top ear of those stalks that bear the largest number, because on the top ear is always found the genuine typical grain, the others below not having developed sufficiently to produce good seed, on account of an insufficient amount of pollen. Seed-corn should always be saved from those stalks that ripen earliest, to make the season of its maturity as short as possible. Seed-corn should be taken from well-formed ears, tapering uniformly, with straight rows, because they are more easily and better protected by the husk, and bear more grain in regular than irregular and crooked rows."

Another matter of great importance is to plant on

Soil Adapted to the Crop.—If a New Englander viewing our rich western lands should ask me, "Why is your average so much below ours?" I should say one great reason is because so much corn is planted on land unsuited to it. Corn delights in warm black and sandy lands, and you will notice in the reports of the "Hundred Bushel Club," that "sugar tree land," "burr oak land," "drained pond," and "black swamp" lands are mentioned. A large per cent of the land planted in corn is unsuited to the crop. Land which is undrained and so full of water that it remains cold till late in the season, or land which is so hilly that plowing involves great loss from washing, is planted in corn year after year, although it will not produce a crop that will pay for the labor expended on it, and might be profitable if kept in grass

Corn is not an exhaustive crop, and it will pay to underdrain thoroughly your best lands and keep them up by a rotation which will give clover every fourth year, and by applying a liberal dressing of manure to the wheat on which you sow the clover. If this is done, and the clover not pastured at all after harvest, we can often get a heavy growth to plow under the following spring, and grow three successive crops of corn in the rotation. There are some lands so well adapted to corn as to bear continuous cropping. I am familiar with a bottom field in Union County, Indiana, which my grandfather bought in 1838,

and was told that it had grown twenty-five consecutive crops of corn. It has been planted in corn forty-four out of the forty-five years since—having been sown in wheat once—it has never had any manure, and receives no benefit from an overflow, as there is always a swift current that carries off more soil than it leaves. This field still produces profitable crops, and I believe that if put in clover a single year it would restore it to its former productiveness.

Manures for Corn.—In a previous chapter I have said that under ordinary circumstances I thought the farmer could not afford to apply stable manure to the corn crop and that a sod was the best and cheapest manure for it. I believe, however, that it would pay to apply a little manure in the hill to give the corn a start, as the plant-food from the sod is not available early in the season, and such a manure can be easily and cheaply prepared as I describe. Some of our drills and planters already have fertilizer attachments and our manufacturers will furnish them to all whenever the farmers demand them. I should expect good results from a manure composted with bran like that which I used on my potato crop with such good results. It will be easy to experiment with manures in the hill, applied by hand, to determine whether it will pay, and if it does, the fertilizer attachment to the planter can be purchased. I would also advise that experiments be made with plaster, used after the corn is up and applied to the plant when the dew is on.

I have not been troubled with cut worms for several years, but if I should be I would try a mixture of salt and plaster; two parts of the latter to one of the salt. At a meeting of farmers in Logan County, Ohio, I heard the following statement: "I had a field of corn on sod this year, and found soon after it came up that the cut worms were destroying it. They kept it so short that we could not see it in the row and I thought I should be obliged to plant it over. I mixed salt and plaster; two parts of plaster to one of salt, and we applied it at the rate of a barrel of the mixture to eight acres, dropping about a teaspoonful on each hill, and two days after, on careful examina-

tion, I failed to find a stalk injured, and there was no more trouble. We ran out of the mixture and left a half acre on which we did not apply it. On this the worms worked for some time, and the crop was cut short fully one-half." The gentleman further stated that his corn was some days earlier on the part to which the mixture was applied, and that he thought it paid largely as a fertilizer in addition to saving his crop from the cut worm. The remedy is so cheap and easily applied that I would recommend that it be thoroughly tested.

Preparation of Soil.—I believe in thorough preparation of the soil for corn, but soils and seasons vary so much that there are no rules to be laid down. There was a time when the motto

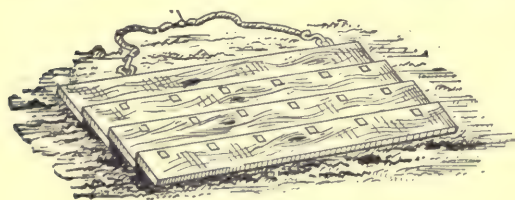
"Plow deep while sluggards sleep,
And you shall have corn to sell and keep,"

was considered profound wisdom, but most intelligent farmers now know that there are soils which would be permanently injured by deep plowing, and that good judgment must be used in this as in other matters pertaining to the farm. I advocate deep plowing on soils which are deep, but I would expect a better crop from six inches well pulverized than from eight or ten inches imperfectly prepared.

Both experience and observation lead me to favor fall plowing for corn on a well-drained soil, and especially where there is much vegetable matter to turn under. I would not rebreak this fall-plowed-land in the spring, even though it becomes packed so as to be quite hard, but would mellow it from the surface with the best implements I could command. The slicing and cutting harrows, such as the "Randall Disk," and the "Acme," are admirable for this purpose, but before I had these I used the two-horse cultivator to break the crust and loosen the surface, and then followed with the heavy Scotch harrow. If I do not plow in the fall I want to do it as early in the spring as the land is dry enough. I can make a seed bed for corn that suits me much better after the land has been settled by rains than if fresh plowed. If I am delayed and must break the land late and plant on fresh plowed land, I never allow it to become dry and

cloddy after plowing, but keep a roller or some other good pulverizing implement in the field, and use it each half day as I plow. It is a matter of the greatest importance in all operations connected with the preparation of the soil, to do the work at the right time. If the roller or drag is kept in the field and used on the fresh plowed land it will always pulverize the clods and compact the soil so as to enable it to retain the moisture, while it is often the case that where an entire field is plowed and left rough and cloddy it will get in such a condition that the farmer must wait for heavy rains before he can prepare a seed bed. A light shower will moisten the smooth mellow surface of the field that was rolled or dragged at the proper time, but will have no perceptible effect on the rough field.

I have spoken of dragging. The drag is a substitute for the roller, and under certain conditions of soil will do better work. It is the cheapest implement that can be had on the farm, and no farmer should be without it. In fact, it will pay to have two or three of different sizes. I always keep a light one to be used with one horse in the garden, and also a two-horse one, and the farmer who runs two teams should have one large enough for four horses. There are two ways of making them,

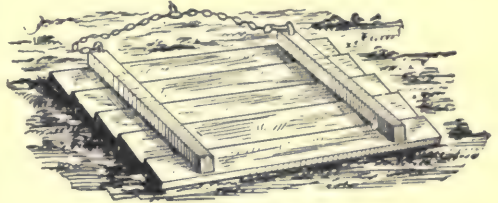


BOLTED PLANK DRAG.

one by bolting plank together as shown in the illustration. Here we simply take two-inch planks and bolt them together with strong carriage bolts, using

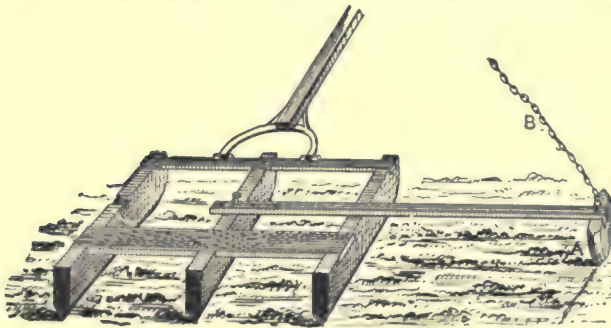
washers with the bolts. I find that four plank, ten feet long and one foot wide, and two inches thick makes a very good size for two horses. We lap the plank on to each other four inches, and put the bolts through from below so as to have the smooth head run on the ground and the tap above. When this is completed it is three feet wide, and if it is not heavy enough it can be weighted. If made of oak and the driver rides, it will be about right, but if of pine or other light wood, some weight will need to be added.

The other plan of making we show in the illustration. In this case, instead of bolts we use spikes, and fasten the plank to end pieces, and if the drag is long, it is well to have a middle piece. You can regulate the weight of your drag by the size of the pieces to which you attach the plank. It is advisable to have a box on the drag into which you can drop stones to carry them from the field. This drag if used at the proper time, either when the land is freshly plowed, or as soon after a rain as it will crumble, will put the land in fine condition for the sled marker.



SPIKED PLANK DRAG.

The sled marker is another cheap and valuable implement which the farmer can make himself. I think it a great advantage to plant corn near the surface instead of at the bottom of a furrow, as was the universal practice until the introduction



SLED MARKER.

of machinery for planting. The corn plant delights in heat, and if planted in a furrow which is filled with water by every heavy rain, and where the roots

are not in soil well exposed to the sun, it does not start so quickly into rapid growth as if nearer the surface. The sled marker has runners three inches thick, beveled on both edges so as to make a V shaped mark about three inches deep. This leaves plenty of mellow earth under the corn, and when it is covered, the field is very nearly level. A shows a reversible marker which is changed from side to side. B is a rope by which it is attached to the hame hook on the horse. This makes a mark which is a guide in returning, and saves setting stakes, as by keeping the tongue over this mark you keep the

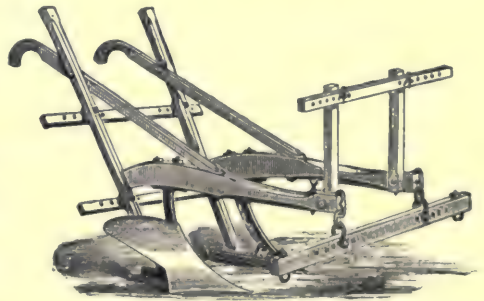
right distance between the rows. If the two-horse lever planter is used, you drive across these marks, but if the drill, you run the wheel of the drill in the mark. On farms where there are large fields clear of stumps, the two-horse planter, with a check-rower, can be used without marking out at all, and will drop the corn so that it can be cultivated both ways.

Both hill and drill culture have advantages. It is easier to keep a field clean in a wet season when you can plow both ways, but there is little question that more corn can be grown by the more equal distribution of stalk which the drill gives. I think we can get closer to the corn at the first plowing when drilled than when in hills, for the grains in the hill are, or should be, scattered a little. With suitable implements for cultivating, such as are now easily obtained, there is little difficulty in keeping drilled corn clean, but if the land is foul, or the farmer has not the right implements, I would advise hilling. I think that under ordinary circumstances about one and a half inches is the best depth to cover corn. It is a fact, perhaps not generally known to farmers, that the young plant can receive no nutriment from the soil till the leaves reach the surface, and expand in the light and air, but is nourished by the plant food stored in the grain, and if planted too deeply this will be exhausted, and the plant enfeebled before it comes up. We usually begin the cultivation of corn before it is up, and the condition of the soil and the weather will determine what we shall do. If the land is in good condition, not packed by heavy rains, and warm, so that the corn will come up quickly, and start at once into a thrifty growth, the plank drag run over it a few days after planting will put it in excellent condition for the plow. This must be used before the plumule is near the surface, or some of the stalks will be broken. If a rain falls, and you are not able to get on to the field until too late to use the drag, the harrow should be used, and for this I prefer a sloping tooth harrow, as the teeth may be run directly through the rows or hills without damage. If, however, the soil has been made very compact by heavy rains, a heavy straight tooth harrow will be needed.

For the first plowing, after careful experiment and observa-

tion, I have adopted the bar plow with fender; and after trying several forms of fenders, I give preference to the rolling cutter. With this plow you may run as close as you wish to the corn without covering a stalk. The great advantage of plowing corn in this way, however, is that it leaves it on a narrow ridge, which warms through readily and starts the corn at once into a vigorous growth. When corn is plowed in this way the earth is ridged up between the rows like a sweet potato ridge, and it not only kills all the weeds, but this ridge soon warms up, and when a week or two later it is leveled down and brought back to the corn rows, it is mellow and fine, and of necessity free from weeds. I tested this matter two years in succession. A strip was plowed with the bar plow, as above described, and an adjoining strip cultivated level with the bull-tongue cultivator. In both instances in a single week the difference was plain, the corn plowed with the bar plow being darker in color and a much more vigorous growth. We plow with the bar plow about four inches deep, and run so close to the corn that you can often notice the fibrous roots left bare.

The double bar plow is now largely used for the first plowing, and is growing in favor. The plows can be easily separated and used singly, as they are light and easily guided, so that they can be used with but one handle. With this plow properly adjusted, and a little experience in handling it, you can plow in corn two inches high and not cover up a single stalk. Our cut of the double bar plow shows it without fenders, but they should always be attached to all plows which are used when the corn is small. I think the rolling cutter the best form of fender, as it loosens and cracks the little ridge on which the corn is left standing. At the second plowing we use the bull-tongues on the double cultivator, so as to level down the ridges between



DOUBLE BAR PLOW.

the rows and get the earth back to the roots of the corn. I do not think any rule can be laid down as to how many times corn should be cultivated. In some seasons three workings would give better results than six in others. I believe that as a rule we give too little work, and that the majority of farmers stop the plows too soon. There are many farmers who think that it injures corn to plow it after the tassels show, but if it has not been neglected, and the land allowed to become hard and weedy, I think late cultivation beneficial. Mr. L. N. Bonham, a well known agricultural writer, has experimented in this matter, and states that he has found plowing beneficial, even when the pollen was formed and falling from the tassels.

Corn-fodder and Fodder-corn.—There is no one point in which the opinions of farmers, East and West, vary more than in the estimate they put on corn-fodder. In estimating the value of his corn crop the New England farmer always takes the fodder into consideration, and values it often at fifteen or twenty dollars an acre—sometimes more; while in the West but little value is attached to it, and, as often managed, the farmer damages his land more by getting what he does from it than it is worth to his stock. I have, for many years, been a firm believer in the value of corn-fodder. I have often, for several years in succession, wintered my horses and cattle without any hay. I have always found my stock to relish the fodder better than hay, and to eat it with less waste; and, after over twenty years' experience, I have decided that the fodder from an acre of corn, if properly saved, is worth as much as all the timothy-hay would be that would grow on that acre. I have been confirmed in this opinion by many practical farmers who have had large experience in feeding corn-fodder.

The average yield of hay per acre in the United States is but little above one ton, and rarely, if ever, reaches one and a quarter tons.

I have before me a table giving the result of fifteen trial plots of corn, from each of which the product was weighed, the grain and stalks separately, and the result shows an average of a little over 104 pounds of fodder to each 100 pounds of corn,

and an average yield of fodder per acre of 4,229 pounds. The average yield of corn on the fifteen plots was 58 bushels per acre. I have made quite a number of experiments in feeding corn-fodder, which show that two-thirds of good, dry corn-fodder is eaten by the stock. Now, if we grow fifty-five bushels of corn to the acre, it will give us a little over two tons of fodder to the acre; deduct for the waste one-third, and it leaves us, in round numbers, 2,600 pounds net of fodder from our acre of corn. It is very probable that the chemist would tell us that this was worth much less than hay, but I have always found it more palatable to the stock, and that they would thrive as well on it.

The question to be decided, however, seems to me, not "Is an acre of corn-fodder worth as much as an acre of hay?" but, "Is it worth saving?" The cost of securing the acre of hay, counting the rent of land, will be not less than eight dollars, as the work must be done at a busy, pushing time, when wages are high. This is allowing three dollars for cutting, curing, and hauling to barn or stack, and five dollars per acre for rent of land and taxes. I can secure an average acre of fodder in barn or stack for three dollars. If we put one hundred hills in a shock it gives twenty-seven to thirty shocks to the acre, and, unless the corn is very heavy, I can get it cut for four cents a shock, and have never paid more than five cents for this sized shock. At these prices our cutters will average two dollars a day. We can get the corn husked and the fodder bound in bundles for from one to two cents more a shock than we pay for cutting, or an average of six cents for a hundred hills, and certainly not more than one-third of this should be charged to the fodder, as it would cost two-thirds as much to husk the corn if left standing on the stalk. The cost of hauling, which will depend somewhat on the distance from the barn or stack-yard, does not average above fifty cents a load, or one dollar per acre.

I think the great trouble with farmers in securing their corn-fodder is that it is a job that *can* be postponed. They know that the hay crop *must* be secured, and they engage plenty of

help and finish it at once. But, because corn-fodder can usually stand out several weeks without damage, the farmer puts off securing it, and works along, with insufficient help, till finally winter catches him with half his crop out, and gives him double work to secure an inferior article. Often the deterioration in quality is more than would have paid the entire expense of husking and putting in barn or stack. I believe that no farmer can afford to leave an acre of corn-stalks in the field; the waste alone in the barn-yard is worth half the cost of saving the fodder, as there are few better absorbents than corn-stalks. My plan is to hire a gang of men, and put the work through as quickly as possible after the corn is in a condition to crib.

I spoke of binding with rye-straw. We grow a small piece of rye each season for this express purpose, and cut it when in blossom, as this gives us a tough, elastic band, and we do not scatter rye over our fields, as we are sure to do if the grain has been allowed to ripen; and, as we usually seed with wheat on the land where corn has been cut up, we do not want a mixture of rye.

There is no point that needs more careful watching than the binding of fodder, and it is wise to select one of your best and most careful hands for this part of the work rather than to have the huskers do it. The bundles should be medium-sized, and bound near the middle. Rye-straw is long enough, so that a single band will make as large a bundle as is convenient to handle; but I prefer to turn half the straw of which the band is made, so as to have the band of equal size throughout. A band made in this way is much less likely to break than if the heads are all one way.

There is no product of the farm that can be so easily stacked to turn water as corn-fodder. I prefer to put up medium-sized stacks, from seventy-five to one hundred shocks to a stack, so as not to expose much fodder to the weather in feeding. It can be fed directly from the stack, or a stack can be moved into the barn. All that is necessary to make it turn water is to keep the middle full, so that the bundles will have a good slope to the outside of the stack, and take pains in topping out.

While I am an advocate of corn-fodder, I have never liked sowed corn for winter feeding. It is difficult to cure so as to keep when stored away, and seems to be deficient both in nutrient and flavor. My stock do not eat it well, or appear to thrive as well on it as on fodder from corn which has matured a crop of grain. I am of the opinion that the best way to grow corn for cattle feeding is by thick planting, so that there will be a large growth of fodder and small ears—this to be fed without husking. Some years ago, in visiting Mr. Chauncey Hills, a prominent short-horn breeder, of Delaware, O., he told me that he found it his most profitable crop. My recollection is that he planted this corn about twice as thick as is usually done, having the rows the usual width apart, and the hills from eighteen inches to two feet apart in the row.

In the experimental work at our agricultural colleges careful tests are being made to determine the most profitable distance apart to plant corn. At the Ohio experiment station this work was begun in 1882, and I give entire the tables, which show the results of planting at different distances apart for the years 1882-83.

EXPERIMENTAL CORN PLOTS FOR 1882.

Table 1.

Number of plots..	Number of stalks in hill.....	Distance between hills, in inches.	Bushels sound corn per acre, 70 lbs. each...	Bushels soft corn per acre, 70 lbs. each.....	Total bushel per acre.....	Percentage of soft corn.....	Weight of stalks Per acre, lbs...	Weight of stalks to 100 lbs. corn, lbs.....
1	1	6	54.2	9.7	63.9	15.1	5,369	120.
2	1	9	53.1	9.3	62.4	14.8	4,375	100.1
3	1	12	56.4	5.6	62.	9.	3,906	94.3
4	1	15	53.6	6.7	60.3	11.1	3,874	91.
5	1	18	49.1	5.4	54.5	9.9	3,282	86.
6	1	21	46.5	7.8	54.3	14.3	3,419	89.9
7	1	24	37.1	4.7	41.8	11.2	3,185	108.8
8	2	12	58.4	8.3	66.7	12.4	4,996	107.
9	2	18	56.3	7.2	63.5	11.3	5,021	112.9
10	2	24	56.7	6.3	63.	10.	4,368	99.
11	2	30	53.3	4.7	58.	8.1	3,822	94.1
12	3	18	50.3	11.7	62.	18.8	5,499	126.7
13	3	24	46.8	9.	55.8	16.1	4,303	110.1
14	3	30	45.1	10.1	55.2	18.2	4,251	110.
15	3	36	39.1	8.2	47.3	17.3	3,770	113.8

EXPERIMENTAL CORN PLOTS FOR 1883.

Table 2.

No. of plot.....	HOW PLANTED.			Bushels of sound corn 70 lbs. each.....	Bushels of soft corn 70 lbs. each.....	Total amount of bushels 70 pounds each	Per cent of ears.....	Per cent of nubs.....	Total number of ears and nubs.....	Total number of stalks	Total weight of stalks.....	Aver. weight of corn for 1 stalk.....	Weight of stalks to 100 pounds of corn.....
11	kernel,	6 in.		55.09	5.8	60.89	6.37	93.63	14,048	24,368	10,208	.17	240
21	"	9 "		86.6	2.3	88.9	33.77	66.23	12,176	14,096	7,360	.44	118
31	"	12 "		85.3	0.7	86.0	50.4	49.6	9,808	11,120	7,104	.54	118
41	"	15 "		80.0	0.9	80.9	61.1	38.9	8,352	8,768	6,368	.64	112
51	"	18 "		71.6	0.0	71.6	70.0	30.0	6,560	6,912	5,088	.73	101
61	"	21 "		67.0	0.0	67.0	73.1	26.9	6,368	5,984	4,800	.78	102
71	"	24 "		72.9	0.0	72.9	76.6	23.4	6,496	6,272	5,184	.81	101
82	kernels,	12 in.		77.5	5.5	83.0	17.7	82.3	14,464	23,648	7,744	.25	133
92	"	15 "		87.8	4.3	92.1	34.3	65.7	13,232	20,480	6,528	.31	101
102	"	18 "		84.8	2.3	87.1	40.8	59.2	11,904	17,248	7,008	.35	115
112	"	21 "		77.3	1.4	78.7	45.2	54.8	11,424	14,816	5,728	.37	104
122	"	24 "		78.0	1.4	79.4	55.2	44.8	10,144	12,832	5,184	.43	93
132	"	27 "		66.8	0.7	67.5	58.8	41.2	9,120	11,488	4,480	.41	95
142	"	30 "		76.6	0.0	76.6	66.6	33.4	8,624	10,272	5,024	.52	94
153	"	18 "		59.7	3.4	63.1	14.2	85.8	12,960	25,296	7,104	.17	161
163	"	24 "		59.9	0.0	59.9	29.3	70.7	11,680	19,104	5,760	.22	137
173	"	30 "		62.9	0.5	63.4	57.2	42.8	10,208	15,456	5,024	.29	113
183	"	36 "		76.1	0.5	76.6	68.3	31.7	9,664	12,624	5,024	.42	94

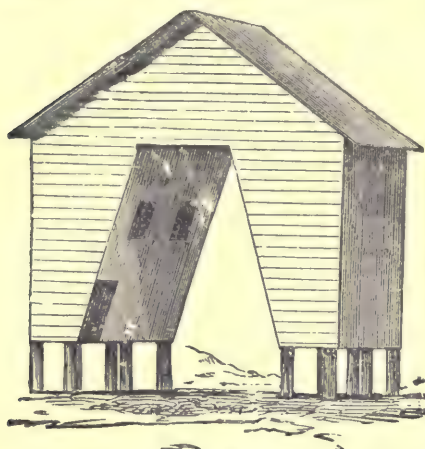
These tables should be carefully studied. It will be noticed that more details are given in the table for 1883 than for the previous year. It is the intention of the manager of the station, "Professor Lazenby," to continue these experiments for a long series of years. The experiments are conducted with the utmost care. The land was carefully selected and all prepared in one day, and the planting and cultivation was exactly the same for all the plots. The rows were three and a half feet apart. In the table for 1882, in every case you will notice that close planting gave the heaviest yields of grain, the lightest yield being from one grain twenty-four inches apart, which yielded forty-one bushels of corn per acre, and 3,185 pounds of stalk, or a total weight of corn and stalk of 6,055 pounds per acre. Plots 1, 8, 9, and 12, all of which were much closer than farmers usually plant, yielded respectively of grain, 63+, 66+, 63+, and 62 bushels per acre, and a total weight—cured—of corn and fodder of 9,779, 9,616, 9,431, and 9,839 pounds per acre. The year 1882, in which this experiment was made, was unfavor-

able for the growth of corn in the earlier part, but was very favorable at earing time.

Table No. 2 shows some remarkable yields both of corn and fodder; but as this season dry weather prevailed at earing time, the largest yields of grain are not from the thickest planting, as was the case the previous year. Five of the plots, Nos. 1, 2, 3, 8, and 10, yielded of corn and fodder over six tons each per acre.; No. 1 producing over seven tons. The five plots referred to averaged about eighty bushels of corn per acre, about seventy per cent of which was nubbins, which makes it very suitable for feeding to cattle without husking, I am fully convinced that no crop the farmer can grow will afford so much and so good cattle feed as this closely planted corn, and in looking at the figures given in these tables the question naturally arises: "Why should farmers winter their cattle on an exclusive hay diet, which has been grown at the rate of one ton per acre, when from three to seven tons of better food can be so easily produced"—for there is no doubt that the corn and fodder fed together will give better results than feeding hay. Even if one-third of the weight of this crop goes into the waste, it would still leave from two to four times as much food as the same land in hay would produce, and if run through a cutter before feeding, this waste would make excellent bedding and one of the very best absorbents.

Probably there is no question connected with stock-feeding that will pay so well for careful experiment, as that of growing and feeding of corn and fodder, and I believe that careful experiment would show that a single acre of this crop rightly managed would furnish food to winter two cattle of one thousand pounds each, while under the hay feeding system it will take about two acres to winter one. I can not give better advice to farmers than that they experiment with thickly planted corn to determine how much food can be produced per acre and the relative value of that food. It should be remembered, however, that the planting should always be thin enough so that the corn will produce ears, as this not only furnishes grain for feed, but also improves the quality of the fodder.

Disposing of the Crop.—I think that too many farmers sell their corn. If the crop is fed to scrub cattle, "Elm-peeler"



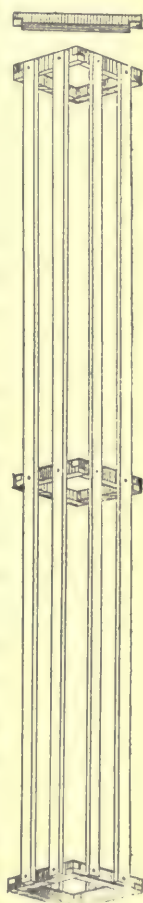
CORN-CRIB.

hogs, or old horses, it will, no doubt, fail to be profitable. But the farmer who keeps good stock, and manages well, will certainly realize a greater profit from his corn by feeding than by selling it, and will at the same time keep his farm in better condition. The cost of taking a thousand bushels of corn to market even a few

miles is considerable, while the beef or pork which it represents can be driven the same distance in a few hours.

It is best that the corn should be stored in a separate building, as it needs thorough ventilation, and it is much easier to protect it from rats than when the crib is connected with the barn. The crib shown in the illustration is probably the best and most convenient that can be made, and it can be utilized for a wagon-shed as well as a corn-crib. It is easy to make such a crib rat-proof, as it will be impossible for a rat to hold on to the outside of the crib long enough to gnaw into it. The foundation may be of stone or brick; or posts of durable wood like locust, if set below frost, will answer the purpose. The building should project a little beyond the foundation, so that a rat, even if it climbed up to the crib, would then find it impossible to get to the slats.

As in some seasons we are obliged to crib corn damp, it will be wise to arrange for extra ventilation in such seasons. This can be done by making trap-doors, eight inches square, in

VENTILATOR
FOR CRIB.

the center of the floor, and above these place ventilators, extending up to the top of the crib. These ventilators can be made by first putting together some small square frames of two by four studding, so that they will measure nine inches outside measure, and nailing two strips, three inches wide, of inch boards to each of the four sides. Probably four of these frames would be needed for each ventilator ten feet long, as the pressure of the corn would crush them if the space between frames was too great. With a row of these ventilators placed five or six feet apart along the center of the crib, such thorough ventilation would be secured that the risk of damage would be greatly reduced. About thirty feet of lumber would be required for each ventilator ten feet long, and when once made they would last for many years. When not in use they could be stored overhead.

Our engraving on page 164 shows how the frames should be made, and also a ventilator complete.

CHAPTER VIII.

WHEAT.

IN many parts of our country wheat is the most important crop the farmers grow. Its importance is due to the following facts:

1st. It is a crop which always commands the cash, and is always in demand.

2d. It divides the work so that a single team can do much more work on a farm where wheat and corn are grown in about equal proportions than where corn is the sole or principal crop.

3d. It can be successfully grown on rolling lands, which, if continuously cultivated in corn, would soon be ruined by washing.

4th. It gives an opportunity to start clover to occupy the land, and furnish plant food for succeeding crops, and is, therefore, an almost essential crop in any good rotation.

5th. It can be easily stored; there is little risk of injury from dampness, and, almost no loss from shrinkage, and at the usual prices, a team can take to market four or five times as many dollars worth of wheat as of corn.

6th. Probably no farm crop grown gives such certain and large returns for manure as this, and at the same time, under proper treatment, leaves the land in good condition for a succeeding crop.

7th. It furnishes the farmer with a large bulk of straw, which can be utilized for food, bedding, shelter, and as an absorbent for liquids, which would, without it, on many farms, be wasted.

8th. As wheat is exported to a large extent, and can be held for one or more years, if desired, it is less subject to fluctuation of price than most other crops.

tuations in price than many other farm products, and is not so likely to be depressed by an unusually heavy crop.

The aggregate production of wheat in the United States has rapidly increased during the last ten years.

The following table shows the total production, value, and area of the wheat crop of the United States from 1871 to 1880, inclusive:

Year.	Bushels.	Dollars.	Acres.	Value per bush. cents.	Value per acre, dollars.	Yield per acre, bushels.
1871	230,722,400	290,411,820	19,943,893	125.8	14 56	11.5
1872	249,997,100	310,180,375	20,858,359	124.0	14 87	11.9
1873	281,254,700	323,594,805	22,171,676	115.0	14 59	12.7
1874	308,102,700	291,107,895	24,967,027	94.4	11 66	12.3
1875	292,136,000	294,580,990	26,381,512	100.0	11 16	11.0
1876	289,356,500	300,259,300	27,627,021	103.7	10 86	10.4
1877	364,194,146	394,695,779	26,277,548	108.2	15 08	19.9
1878	420,122,400	326,346,424	32,108,560	77.2	10 16	13.1
1879	448,756,600	497,030,100	32,545,950	110.8	15 27	13.8
1880	480,849,723	460,597,000	36,037,000	95.8	12 74	13.3

It will be noticed that the average price for the entire period of ten years is \$1.05½ per bushel; the average yield per acre, 13 bushels; the acreage nearly doubled during the ten years; and the average per acre for the last four years is 15 bushels against 12 for the first four years, and 13 for the entire period.

This increase in the amount of wheat grown is due to several causes, among which are the opening up of new and fertile wheat lands in Minnesota, Dakota, etc.; the introduction of new and greatly improved machinery for handling the crop; the stimulation of good prices consequent upon a heavy foreign demand; the introduction of better modes of cultivation, and the use of more fertilizers, both home-made and commercial.

One gratifying feature of this increase in wheat production is that it is not due merely to the opening of new and fertile lands in the West, but in the States which have been longest under cultivation, the improvement has been striking. Take, for example, the statistics of Ohio, the leading wheat growing State of the Union. Dividing the thirty-three years, from 1850 to 1882, inclusive, into three periods of nine years each, and one

period of six years, we get the following table of average yield per acre, and average annual aggregate production of the State :

Years.	Average yield per acre.	Average annual crop.
From 1850 to 1858	12.89	21,000,000
From 1859 to 1867	9.86	17,000,000
From 1868 to 1876	12.11	20,000,000
From 1877 to 1882	16.25	39,000,000

The favorable showing of the first nine years is probably to be accounted for in part by the larger proportion of virgin soil at that time, and partly by the fact that statistics had not then been reduced to as complete a science as since.

Two causes account for the extremely unfavorable showing of the second period; the absence of a large part of the agricultural class in the army reduced the number of acres under cultivation, and the disastrous crop failures of 1865 and 1866 reduced the average per acre, which in 1865 was but nine, and in 1866 but four and a half bushels. The wet season of 1875 explains why the third period did not quite equal the first one. The fourth period of six years marks apparently a new era in wheat growing, the annual aggregate production being doubled, and the average yield per acre being increased forty per cent. This greatly increased yield was doubtless due to better drainage, better preparation of the soil, better fertilization, including a larger use of commercial fertilizers and the introduction of new and improved varieties.

Soil.—Wheat flourishes on a great variety of soils, the essential conditions being good natural or artificial drainage, as it is easily injured by excess of water in the soil, and a supply of available plant food. A limestone clay, under favorable conditions, is probably one of the safest soils for the crop, but it is grown with success even on rich black bottom soils.

Drainage.—There is no crop which is more benefited by drainage than this; in fact, it is scarcely wise to attempt the cultivation of wheat on a soil that is not drained, either naturally or artificially, as a profitable crop can only be grown on such

land in exceptionally favorable seasons. If the surface soil is filled with water during the winter and spring, the freezing and thawing will heave out the young plants, and if water remains upon the surface, the result will be even more disastrous.

Where the surroundings or the circumstances of the farmer are such as to make thorough underdrainage impracticable, very good crops may often be secured by plowing in narrow lands and opening out the dead furrows, making provisions for a clear outlet, so that the water will never stand in these furrows. It will be sufficient for this purpose that the furrows be opened without rounding the lands. The latter practice, by giving a greater depth of soil in the center of the land, is liable to cause the crop to mature unevenly. An outlet should be opened with the plow to every low place in the field, so as to prevent the water from standing on any portion of it. Of course, these open furrows across a wheat field are objectionable, and greatly interfere with the convenient use of machinery; but they are less objectionable than the loss of a crop from excess of water. As soon as thorough underdraining can be accomplished, these open furrows may be dispensed with.

Preparation of the Seed Bed.—I believe that the increased yield of wheat during the last few years is due more to the care and intelligence in this matter than to any other one cause. One important point is early plowing. This is especially true on the clay lands of which I have spoken as particularly adapted to wheat. Our farmers have found that wheat does best on a seed bed that is compacted with a few inches of mellow soil at the surface, and that this can be secured best after the land has been plowed for some time and has been settled by rains.

I have often had an opportunity to notice the difference between early and late plowing, where a farmer began plowing a field in July, and stopped when the ground became hard and was unable to finish until September. In such instances I have seen in the same field a difference of ten bushels to the acre in favor of the part which was plowed early. I do not think the farmer ever likely to make a mistake by putting too much work

on his wheat land in the way of mellowing and fining. The best yield I ever secured was on a field that I harrowed, rolled, and dragged six times between breaking and seeding. I fully believe in the truth of the maxim, "Tillage is manure," and that a soil which is kept mellow and fine for six weeks or two months during the heat of summer, becomes vitalized and enriched so as to give the young plant a thrifty start.

It is of the utmost importance in all the work of preparing the seed-bed for wheat to so arrange that the work can be done at the right time. During the heat of summer we usually have after each rain, one or two cool, cloudy days. This is the time when the teams should be kept at work early and late. The land is moist and turns up easily, and the team will do twelve or even fourteen hours of work with less strain and worry than they will do eight a week later, when the ground has become dry and the mercury is up in the nineties. It is the same with the work of pulverizing. There are times when one day's work will accomplish more than three a little later. There is a time after a rain when the ground will crumble at a touch, and if the farmer can go on his fields then with a harrow that will take a wide sweep he can mellow a large amount in a day, and leave it in a condition to be benefited by sun and air, while if neglected a few days, till a crust forms, it will be impossible to get it in good order till another rain falls.

My advice in preparing land for wheat is to roll as soon as plowed. At the first plowing after a rain it will do to plow a day or sometimes two days before rolling, but as the weather gets hot and the land begins to dry, roll each half day, and under some circumstances it will pay to unhitch from the plow and hitch to the roller as soon as a sufficient number of furrows are plowed to make a round for the latter. I think that any farmer who will give this plan a fair test will never abandon it. It is wonderful what power of retaining moisture a fine soil has. A field that is at once made fine and compact with the roller will be put in excellent condition for seeding by a shower which would not make any impression on a field that had been left rough and cloddy. I think there can be no beneficial chemical action in

the soil without moisture, and the field which is allowed to be baked and hard for some weeks previous to seeding time, loses the cheapest and best source of fertility which is at the command of the farmer.

If any of my readers think I am giving undue prominence to this matter of pulverization, I would recommend that they test it on a strip in the field, and continue the experiment for a series of years that they may hit both dry and wet seasons. I am sure that the experiment will result in convincing them that thorough preparation of the seed-bed is one of the most important points connected with the crop.

There are seasons when it is impossible on account of dry weather to plow early for wheat; and when the plowing must be done just before sowing, I would recommend that it be shallow, four or at most five inches. A deep, loose seed bed holds too much water, and if we can not have our land settled and compact it is best to plow only what we can thoroughly pulverize, and I think that four inches of soil made fine and mellow is better than eight less thoroughly fined. The seed is also likely to be covered too deeply on the loose soil.

Wheat on Corn Lands.—There are many farmers who think it slipshod farming to sow wheat on corn land; but on a farm where a large breadth of land is devoted to corn, and in a locality too far south to find oats reliable or profitable, it becomes a necessity in our rotation to seed corn-land to wheat. I seed more or less in this way each year, and grow full average crops, frequently obtaining twenty-five to thirty bushels to the acre in this manner; and my neighbor, L. N. Bonham, grew on corn-land a crop that averaged thirty-eight bushels. I do not sow in the standing corn, but cut and shock the corn before seeding. Mr. Bonham, whom I have just mentioned, one year seeded a corn-field to wheat, sowing one-half of the field in the standing corn, and cutting off the corn on the other half. Equal care was taken in the preparation of the land in each case and the wheat put in with a one-horse drill, but the yield on the portion where the corn was cut up before seeding was more than double that on the other half.

I never plow the land where corn has been cut off, but work it mellow with cultivators and harrows. The first thing to be attended to is to keep the corn clean, plow as late as you can, and then if necessary go through with hoes. I prefer putting twenty rows of corn in a shock row, setting the shocks close, and do not try to seed between them. Then with the best implements at command, go to work and mellow three inches of the surface of the field. Sometimes this can be done with a common harrow, followed by the roller or plank drag, but if the ground has been compacted by heavy rains the cultivators or one of the improved cutting harrows will do the best work, and should be used if practicable.

Whatever implements are used the land should be in fine order before starting the drill. It is better to be a week or two later with the ground in good condition than to secure earliness by imperfect preparation.

Fertilizers.—The cheapest wheat I have ever grown was on a clover sod, turned under early and given time to thoroughly decompose; and when I do not put wheat on corn land, my preference is to so arrange a rotation as to have a crop of clover followed by two crops of wheat, applying fertilizers to the second wheat crop.

I regard stable manure as the best and most reliable fertilizer for wheat, and have never been disappointed in its effects. I think universal experience shows it to furnish all the elements needed by the plant. From the records of work at the experiment stations, and from my own observation when I have visited them, I see stable manure is always the standard, and nearly always gives the largest yield. In my own experience I have rarely failed to get an extra bushel of wheat for every two-horse load of manure applied, and think I have sometimes obtained twice this amount. If I had an unlimited supply of stable manure, I would apply twelve loads to each acre; but as I never have enough for all my wheat land, I prefer to spend more time and labor in fining it, and make eight loads cover an acre. I would always apply manure to wheat as a top dressing, spreading it after the ground has been plowed

and rolled, and thoroughly mixing it with the surface soil by harrowing.

Bone-meal and superphosphate have at times given me excellent results on wheat; at other times I have received no benefit. When I use them alone I apply two hundred pounds of either to the acre, but prefer to apply one hundred pounds to the acre, and four loads of stable manure. The use of stable manure in connection with the commercial fertilizers is more particularly important when bone-meal is used, as the latter is so slow to decompose that it gives the plant but little aid in making a start in the fall. Superphosphate has not this disadvantage. We begin in May or June the work of getting ready the stable manure we intend to use on the wheat, and endeavor to have it in such condition that it can be handled without loss of time, for where we have to put wheat on corn-land every day is precious.

How and When to Sow are questions of importance. In answer to the first, I say emphatically with the drill. There seems occasionally a disposition to go back to the old methods, and because during some of the years of bountiful yields when every thing was favorable there have been heavy crops grown by broadcast sowing, some farmers are advocating that we throw aside the drill and go back to the old method. Should any do so, I think a little experience in bad seasons would convince them of their mistake. In the fall of 1882 I drilled in a field and left a strip two rods wide at one side with which to experiment with different amounts of seed per acre, and these experimental plots I sowed broadcast. The winter proved a very hard one, the cold being excessive, and March gave cold nights and thawing days, and my broadcast wheat was entirely killed, while the drilled wheat made a half crop. The advantages of drilling are, even seeding at uniform depth, and the protection afforded the plant by the ridges between the rows, which not only protect from the wind, but also crumble and protect the roots during the freezing and thawing of winter. I sometimes see a recommendation to roll wheat after drilling. I think that rolling would largely defeat one object of drilling and that the

wheat would be much more liable to be frozen out than if the land was left in ridges by the drill.

I am in favor of early sowing, and prefer the first half of September if the weather is suitable. It is wise to have the land in order the first of September, and then take advantage of the first favorable weather. I find it much better to seed after a rain than before, as a heavy rain after seeding packs the ground and the wheat does not make a thrifty start. If one has a large crop to sow he can not wait, but must take his chance; but with only two or three days' work to do, advantage can be taken of weather and the crop put in at the best time. I have grown excellent crops of wheat sown as late as the 10th of October. The time to sow will depend much on the season as well as latitude. I would not usually sow wheat while the weather is very warm, as there is more danger of injury from insects; nor do I like to sow when the ground is too dry to give the wheat a prompt and uniform start. The best time to sow wheat is one of those questions which can not be definitely settled, but on which the farmer must use his own judgment. In seasons or localities when the fly works on the crop, early seeding will sometimes fail entirely, while wheat sown a month or even six weeks later will make a good crop. In very dry seasons it is usually wiser to wait for rain and sow later than to run the risk of putting the seed in dry soil.

Thick or Thin Seeding is a matter in which I have felt a deep interest and have experimented on to some extent. My experiments have all been with Fultz wheat (which is a small-grained variety), and have led me to believe that three pecks of seed will produce all the wheat the land is capable of bearing. In 1877 I sowed two adjoining acres in wheat, using a half bushel of seed on one acre and a bushel on the other. There was a perceptible difference in the appearance of the two plots during the first two or three weeks, but less as the wheat began to stool, and in the spring I could see no difference. At harvest there were fifty-two shocks on one acre, and fifty-three on the other, and the product was seventy bushels from the two acres. In 1878 I sowed six acres with three

pecks of seed to the acre, and harvested thirty bushels to the acre. Careful experiments at the experimental farm at Columbus have shown, however, the largest yield from comparatively heavy seeding.

Depth.—Many experiments have shown that the best results are obtained from shallow planting. I would recommend from an inch to one and a half inches. Below I give a table showing the results of experiments made at the Agricultural College, at Lansing, Mich. The first column shows the depth of planting, the second the time that elapsed between planting and the appearance of the plant above the soil, and the third the proportion of the seed that grew.

Depth.	Time in coming up.	Proportion of seed that grew.
$\frac{1}{2}$ inch	11 days	$\frac{7}{8}$
1 "	12 "	all
2 "	18 "	$\frac{7}{8}$
3 "	20 "	$\frac{3}{4}$
4 "	21 "	$\frac{1}{2}$
5 "	22 "	$\frac{3}{8}$
6 "	23 "	$\frac{1}{8}$

It was also noticeable that the plants from the deep sown wheat were weak and lacked vigor.

Varieties.—I do not propose to recommend any variety above all others, for different localities undoubtedly require different varieties. I have found, however, in an experience of thirty-five years as a wheat grower, that there is a tendency with most varieties to deteriorate or, as the farmer usually expresses it, to "run out," when long sown on the same soil. I have found it of so much advantage to change varieties occasionally, that I rarely allow a year to pass without testing some new kind, and I heartily recommend farmers to adopt this plan. There is not now a single variety of wheat growing in my neighborhood that was grown here twenty years ago. I have no doubt but that the introduction of the Fultz wheat in Ohio added millions of dollars to the wealth of the farmers, but after growing it for nearly ten years on my farm, it is beginning to show signs of deterioration, and I am testing other varieties to supersede it.

In trying a new variety, unless it has already been tested in your own locality, I would advise that but a single bushel be

sown. This is more than enough, if it proves a failure, and if it does well will furnish seed for a large field the following year. Never discard a tried variety that is giving good satisfaction till you have thoroughly tested another and are sure it is better. In choosing a variety of wheat, it is wise to grow one that suits the market. A quarter of a century ago white wheat was worth ten or twelve cents a bushel more than red. Now, this is changed, white wheat is not wanted, and can only be sold at a discount.

There are other points to be considered in selecting a variety. One that ripens early is less likely to be damaged by storms or rust than a late kind. Some have soft straw, and are consequently liable to lodge; while still others have a soft grain which sprouts easily, causing liability to damage in a wet season. I discarded the Clawson for this reason after two years' trial, for I found it would grow badly in the shock, when the Fultz and other hard varieties showed no signs of sprouting. The smooth varieties have nearly superseded the bearded as far as I know, and I greatly prefer them, as they are pleasanter to handle and not inferior in yield or quality.

The following description of different varieties, taken from the report of the Ohio Experiment Station, will be useful in enabling a farmer to make a selection for experimenting:

BRIEF NOTES DESCRIPTIVE OF STANDARD VARIETIES.

• **CLAWSON.**—A smooth white wheat with soft grain. This variety has been grown for several years upon the farm of the Ohio State University. Although it continues to yield fairly good crops, it shows some signs of deterioration. It has a tendency to lodge, and the straw is very brittle when ripe. The grain is frequently more or less shrunken. Among its qualities are hardness, and a freedom from rust and smut; although less productive than some other varieties, it is still worthy of cultivation.

FULTZ.—This variety is sometimes called the Red Clawson. Few sorts cultivated in Ohio have given uniformly better results; it is early, has large, smooth heads, and strong straw of medium height. For the past two or three years it has shown a ten-

dency to rust, and is also affected more or less with smut. It is the leading variety in many parts of the State. It appears to do better, in comparison with other varieties, upon high grounds and light soils than on bottom lands or heavy clays.

SILVER CHAFF.—This is now quite widely disseminated throughout the State, and, under favorable conditions, is one of the most productive varieties. It is a white, bald wheat, with a rather coarse straw of medium strength. It is not troubled with rust, ripens a few days later than the Fultz, about the same time as the Clawson.

VELVET CHAFF.—This variety continues to grow in popular favor. Although less productive than some other kinds it maintains a good average. It has rather short, but well filled heads; straw erect and moderately strong. It is sometimes troubled with smut, though not often seriously affected. Like nearly all red, bearded varieties, it is very hardy, good to sow in exposed situations. It ripens about the time, or a little earlier than the Fultz. Its milling qualities are good.

ARNOLD'S GOLD MEDAL.—A bald, white wheat, with large, compact heads; somewhat variable as to yield and quality of grain. Very productive under favorable conditions. It ripens late, and shatters badly, unless promptly harvested; was formerly much prized by millers, but is not now so highly regarded.

GOLDEN STRAW.—A red wheat, which ripens early, and is fairly productive. The heads are bald, small, compact, and well filled. Grains of small size, usually plump. Straw short, of medium strength, not perfectly hardy, and often suffers from winter killing; is worthy of trial, but should be experimented with carefully.

MEDITERRANEAN.—An old standard sort. Heads small, loose, and heavily bearded; not very productive, but sure. Straw tall, rather weak, and inclined to lodge on rich ground. Yield and quality of grain quite variable. One of the hardiest varieties, but is being rapidly superseded by more productive sorts. Its milling qualities are good.

LANCASTER.—A variety resembling the Mediterranean, but more productive. Heads large, and usually well filled. Straw

long and rather weak, not much troubled with rust; milling qualities excellent.

ZIMMERMAN.—A smooth, red wheat, ripening early. Heads rather small, compact, and well filled. Straw short and strong; it is somewhat variable as to yield. In Central Ohio, it is among the more productive sorts. It is a variety worthy of trial, and worthy of a systematic effort to improve it. Its milling qualities are unsurpassed.

SANDOMIRKA.—A bald wheat with white grains and red chaff; introduced from Poland. Heads medium size, compact. Straw long and stout, inclined to rust. It ripens late; one of our most productive varieties; not perfectly hardy, though it usually stands the winters well in Central Ohio.

RICKENBRODE.—A white wheat. Smooth, rather short, compact heads. Straw medium length and strong. Quite variable as to yield; does not appear to be a very profitable variety for Central Ohio. There are good reports from it from Michigan and elsewhere. It is liked by millers.

GERMAN AMBER.—A variety worthy of more extended cultivation. It is a bald wheat, with large compact heads. Grains large, plump, and heavy. Straw rather tall and weak. Yield uniformly good; ripens with the earliest; inclined to rust.

HEIGE'S PROLIFIC.—This variety has only given a moderate yield, but should be tested farther. It is a red wheat. Heads smooth, large and compact. Straw moderately tall and strong. It ripens early. Grain rather small, but plump and heavy.

THEISS.—A red, bearded wheat. Heads variable in size. Straw of medium length and rather weak. Yield and quality of grain variable. Winter kills badly at times. Should be experimented with cautiously.

YORK WHITE CHAFF.—A very promising variety of white wheat for the Western States. It is bald. Heads large, quite compact, and well filled. Quality of grain excellent, yield usually large. Straw tall and long; but little tendency to rust. Milling qualities reported as pretty good.

RICE.—A smooth, white wheat. Heads rather large and compact. Kernels medium sized and heavy. Straw very tall,

weak, and much inclined to lodge; slightly rusted. Probably of less value than many others, but worthy of a thorough trial.

McGHEE'S RED.—A bald, red variety, very productive. Heads large and fairly well-filled. Straw of medium height and rather weak; somewhat rusted. A very productive wheat of good milling qualities; well worthy of an extended trial.

TAPPAHANOCK.—A white wheat; moderately productive. Heads smooth and rather small. Kernels small, but hard. Milling qualities excellent. Straw of medium length, and not very strong; inclined to rust. Yield variable. Of doubtful value.

TREADWELL.—A white wheat of uncertain value. Heads about medium size, not bearded. Kernels large and of good weight. Straw of good height and strong. Milling qualities good.

SMITH'S IMPROVED.—A bearded, red wheat; moderately productive. Heads of fair size and compact. Straw tall and of medium strength; apparently hardy, with no tendency to rust.

RUSSIAN No. 2.—A smooth, white wheat. Heads large and compact. Straw short and strong; inclined to rust. Kernels good size and heavy. Excellent milling qualities. Ripens early, and is proving a valuable wheat.

RED AMBER.—A red wheat, with large bearded heads. Straw tall and moderately strong; no rust. Kernels large, plump, and heavy. Good milling qualities. A reliable and profitable variety.

CHAMPION AMBER.—A red wheat with smaller heads than the preceding. Straw medium length and quite strong. A productive variety, distinguished by its short, compact heads.

FINLEY.—A red wheat, slightly bearded. Heads small and not very compact. Straw medium height and strong. Only moderately productive; should be tested further.

Harvesting.—I have but one or two suggestions to make about harvesting, as there is no work for which farmers are usually so well prepared and do so promptly on time. I believe, however, in cutting wheat greener than most farmers practice. I have never yet lost a bushel by early cutting, but have often escaped storms that blew down my neighbors' grain.

I prefer to cut while the grain is still soft, so that it can be crushed between the thumb and finger, and while there is considerable sap in the straw. In 1878, I cut six acres of wheat so green that the neighbors reported it ruined; but my miller stated at a meeting of our Farmers' Club that it was the best sample of wheat brought to his mill that year. The advantages of early cutting are greater value of straw and, as mentioned above, less risk of loss from storms. There is also less waste from shattering, and the sheaves are pleasanter to handle than if left to stand until the straw is dead and brittle. There is also less liability to injury in the shock, as the sheaves bind together closer, giving less opportunity for water to gain admittance. A much larger amount of wheat can also be stored in a given space if cut moderately green. Shocks made of early-cut wheat will stand better.

Another suggestion is, that the best hands be put to shocking, and that the greatest possible pains be taken to do this part of the work well. A shock well set up and capped will stand out through a long wet spell without damage, when one that is twisted and misshapen will be badly injured. For some years past I have used but one bundle for a header or cap sheaf, and find it much better than two. In a heavy rain some water will penetrate the shock under the cap, and with two sheaves used for this purpose, it does not dry out readily, and the wheat begins to sprout or mould sooner there than anywhere else. Besides, two sheaves when soaked with rain make too great a weight on the shock, and are likely to cause it to twist. Still another objection to two-cap sheaves is that the second cap sheaf is very likely to be blown off in a wind, and very often will, in falling, carry the other one with it. I think a single cap, if well broken and properly placed, will keep out as much rain as two, and, for the reasons given above, be much better. In putting on the cap sheaf, always put the head in the direction of the prevailing winds, as the sheaf will be much less likely to be blown off. In my locality, our winds are nearly always west or north-west, and in capping the shock I place the heads in this direction.

If you do not use the self-binder and expect to glean the field, or the wheat is to be divided in the shock, it will pay to provide extra help, and carry the sheaves so as to shock in straight rows, with a wide space between, as it is difficult to glean, or to divide without making mistakes, if the shocks are set up without order. If the farmer has not barn-room for his grain, and can get the machine and necessary help, it is better, I think, to thresh from the field than to stack. He saves labor, waste, and risk by so doing. It is a serious matter to get a stack wet either while building it or while taking it down. While, if the wheat gets wet in the shock, a few hours of sun and wind will dry it out.

Where the size or location of the barn prevents using it for the purpose of storing the crop, I would recommend the construction of barracks for the purpose, and believe it would pay the farmer to borrow money, if necessary, to put up a cheap building of this kind. A light frame would do, or it could even be made by setting rows of posts of lasting timber, such as oak or locust, and bracing them to support the roof. If the roof projected considerably, it is not absolutely necessary to board up the sides; but I would recommend that they be boarded on the north and west at least, and think it would pay in the long run to board up the entire building. If the posts were sixteen feet high, and the building twenty-five by fifty feet, it would take less than three thousand feet of boards to inclose it, and this would in most localities cost but little above fifty dollars. A building for this purpose could be made with a light frame, as all the weight of the grain would rest on the ground. It could be used with an earth floor, or if a board floor was wanted, it should be laid on mud sills resting on the ground. This building should be made adjoining the barn-yard, so that the machine would deliver the straw where it would be wanted, and after the wheat was threshed, the building could be filled with corn fodder. It could also be used for curing beans, broom-corn, or any special crop which ripened between threshing-time and corn-gathering. A part of the building could be used for wintering calves, then carefully cleaned out in the spring, and

a temporary floor laid before filling again with wheat. In the chapter on the "The Barn and Barn-yard" you will find an engraving of such a building, with a bill of lumber and approximate estimate of the cost.

There is a kind of barracks recommended and illustrated in some of our agricultural books, so arranged that the roof may be raised or lowered, to suit a light or heavy crop of wheat; but when fifty dollars will pay for lumber to inclose a building the size I describe, I think most of our readers will agree that it is better to inclose it than to be at the trouble and expense of raising and lowering a roof.

I predict that in the future there will be more small barn threshers used than at present. There is always more or less waste, and a great amount of discomfort both in doors and out, when threshing is done with the large machines. Feeding the large gang of men, and caring for so large an amount of grain and straw at once, in many cases involves disadvantage and loss. There are now excellent machines which the farmer can operate with one or two horses and four hands, that will thresh and clean from one hundred and fifty to three hundred bushels a day, and with these machines the work can be done much cheaper and with less waste and worry, and the straw can be better taken care of, than when all must be done at once. I think there are many of our farmers who have good barns and a convenient place for a machine, who would find it an excellent investment. I remember when I was a boy that for many years we used one which threshed, but did not clean the wheat, and even this greatly reduced the expense of getting it ready for market. But the machines which can be bought now are much superior to those of that day. At a small expense a suction fan and dust shaft can be attached to one of these stationary machines, so that the dust will be carried outside of the building.

The Value of Straw is a matter on which many of our farmers need to be educated. In many localities it is sold for a pittance to the paper mills; thousands of tons are stacked in wood lots or the corners of fields, and, for all the benefit the farmer receives from it, might almost as well be burned. I

think, ordinarily, every pound of straw should be utilized in some way on the farm. The manurial value of a ton of straw is given in the books on agricultural chemistry as two dollars and forty-four cents, but, as an absorbent by which valuable liquid manure is saved, it is worth much more than this.

The question in which farmers are most interested is the feeding value of straw. Scientific experiments have determined the feeding value of good straw—when a part of a suitably combined ration—as compared with corn, to be that of 47 to 100. But it is neither economical nor wise to feed straw alone. This subject, however, will be discussed in its proper place in this volume.

The proportion of straw to grain varies in different seasons and with different varieties of wheat, but will average about two pounds of straw to one of wheat. So the farmer has about six tons of straw for each hundred bushels of wheat he grows, and if this straw, used intelligently, possesses a feeding value of five dollars or more a ton, farmers should know it, and make a better use of it than most of them do. There is no other cheap country where the grains and richer elements of food are so cheap as in ours, and this fact ought to enable us to use our straw to better advantage; but the fact of cheap grain seems to have led us to be wasteful of our abundant supply of cheaper material.

Cost of Wheat Growing.—I have for a number of years kept an account with each separate wheat field, charging the different items of labor, seed, manure, rent of land, etc. In these accounts I charge, under the head of rent, eight per cent interest on the valuation of the particular field where the crop grows. When manure is applied, I charge the crop with fifty cents per two-horse load, and when I use commercial fertilizers I charge actual cost. I charge one dollar per day for each man and horse, or three dollars for a man and team, and actual cost of harvesting, including board of hands. In estimating the cost of wheat I do not include hauling from the field and threshing, but allow the straw to balance this expense. I copy from my book the accounts kept with some of my fields, beginning with a six-acre field grown in 1877. Two acres of this field was wheat-stubble;

the other four was corn land. No manure was used on the field. The account stands as follows:

Breaking two acres,	\$3 00
Working four acres twice with double cultivator, at 50 cents per acre each time,	4 00
Harrowing and rolling,	6 00
Cutting and picking off corn-butts,	5 00
Four and a half bushels seed, at \$1.00,	4 50
Drilling six acres, at 40 cents per acre,	2 40
Rent of land,	36 00
Harvesting,	12 10
Total,	<u>\$73 00</u>

Cost per acre, \$12.16 $\frac{2}{3}$; yield, 30 bushels per acre, or 180 bushels.

This wheat was sold from the machine at 95 cents per bushel, bringing \$171.00, and gave a profit of \$98.00, or \$16.33 $\frac{1}{3}$ net profit per acre. The cost per bushel was a fraction over forty cents.

In 1878 I sowed eleven acres of wheat on a piece of land that I had recently bought at a very low price. It had never been manured, and was in a run-down condition. I do not think it had grown an average of twelve bushels of wheat or thirty of corn for twenty years. In my account I value the land at thirty dollars per acre, which is more than it cost me. The land was in corn, potatoes, sorghum, and beans the previous season, so that we did not break it, but only stirred, harrowed, and rolled, to get it in condition for the drill. The account stands:

For preparing seed-bed,	\$22 00
Seed wheat, ten bushels at 95 cents,	9 50
Drilling,	4 00
Fifty loads of manure,	25 00
Bone-meal,	6 00
Rent of land, 8 per cent, valuation at \$30.00 per acre, . .	26 40
Harvesting, actual cost,	17 10
Total,	<u>\$110 00</u>

The yield was 241 bushels, a fraction less than twenty-two bushels per acre.

I sold from machine at 95 cents per bushel, and the crop brought \$228.95, which, after deducting cost, left a profit

\$118.95. The cost of this wheat per bushel was a fraction above 45 cents.

The same fall I plowed ten acres of the same field, as the clover failed on it, and the account stands as follows :

Breaking,	\$15 00
Thirty-eight loads manure,	19 00
Bone-meal,	12 00
Harrowing, rolling, and stirring,	13 00
Nine bushels of seed wheat,	9 00
Drilling,	4 00
Rent of land, eight per cent on valuation, \$30.00, per acre,	24 00
Harvesting, actual cost,	16 15
Total,	\$112 15

The field averaged fifteen bushels per acre, and cost 75 cents per bushel. The crop was sold at \$1.05 from the machine. The reader will notice that less than one bushel of seed to the acre was used on all these fields, and that the heaviest yield was from three pecks of seed. I do not mention this as an argument for thin seeding, for the experiments elsewhere referred to seem to show that thick seeding gives the best results, but to show that, in some seasons and with some varieties, heavy crops are certainly grown from thin seeding. The greatest benefit I have derived from keeping accounts with my wheat crop has been in noticing the sure decrease in cost per bushel as the yield per acre increased, and that the extra work and fertilizers were what gave the greatest profit. I believe that, if we could induce our wheat-growers to spend one dollar an acre in extra work on their wheat land in the way of pulverizing, it would add from three to ten bushels per acre to the crop, and largely reduce the cost per bushel.

I have spoken of the value of clover as a fertilizer to the wheat crop, and recommended that it always be sown with it. Clover, under certain circumstances, benefits wheat in another way. We occasionally have a bad wheat season when the fall is unfavorable and the crop makes a poor start, and much of it winter kills, and spring finds the wheat very thin on the ground. Under these circumstances I have often known the crop to ripen prematurely, and shrink so as to be scarcely worth gathering,

caused from the fact that the land was not shaded sufficiently, and a few days of hot sun killed the wheat before it was filled. Under such circumstances a good growth of clover will often save the crop by protecting the soil from the heat until the wheat fills.

The best remedy for most enemies of the crop is a thrifty plant. I have little fear of fly, chinch bug, or winter killing on a manured soil or with a plant that gets a thrifty start in the fall. While there will come an occasional season of short crops, and circumstances beyond our control will perhaps bring a failure; yet he who farms well will often escape, when his careless neighbor loses his crop. In the locality where I live we are not troubled with weeds in the wheat field, but I know that in other places there are pests which give the farmer great trouble and often reduce the yield of his crop. The remedies are: first, early plowing and thorough preparation of the seed-bed, and this has already been shown to be the best way to insure a good crop; and second, the sowing of clover, which occupies the land so completely that other plants can not thrive, and this also is of benefit to the land. So we see that clean farming is good farming, and that only good farming is profitable farming.

CHAPTER IX.

MISCELLANEOUS CROPS.

AS a general rule it is wise for the farmer to depend for the bulk of his income on those staple crops to which his farm is best adapted. There are, however, other crops, one or more of which may often be grown to advantage, and these will be the subject of consideration in this chapter.

Oats.—While in some parts of the country oats are a staple crop, it is usually found in our best corn growing localities that they do not produce a profitable yield with as much certainty as corn and wheat, being liable to damage from drought and rust, and in wet seasons, on account of soft straw, by lodging. In Ohio, Indiana, and Illinois, there is produced from four to six times as much corn as oats. I think it might be made a much more profitable crop than now, in some portions of the country that are usually supposed to be south of the oat belt, if more intelligence were shown in their cultivation.

In all the corn-growing regions with which I am familiar it is the almost universal practice to sow oats on the poorest soil, and manure or fertilizers of any kind are seldom if ever used. Besides this, no other farm crop is usually put in with so little care. I think it will pay farmers to improve their practice and pay more attention to this crop for the following reasons: First, it is an excellent crop in a rotation, enabling the farmer to change from corn to wheat without seeding wheat on corn land, which is considered objectionable by many farmers; second, it is an excellent crop with which to seed land to clover or orchard grass, as the early seeding and mellow seed-bed render a stand more certain than when these are sown with a wheat crop; third, it furnishes a much better food than corn

for working stock, or growing animals possessing more of the flesh formers and less of the fat producing elements. It also gives a pleasant variety of food for our domestic animals.

Oats can be grown on most soils adapted to corn and wheat. Early sowing gives the best results, and they should be put in as soon as the land can be worked. I have sown oats in February, when the March following gave a temperature of eight degrees, and nearly the entire month was cold and snowy; but with the first warm days of April, and before the land was dry enough to work, these early sown oats were up and made an excellent crop. The amount of seed used varies from two to four bushels per acre; but I regard the smaller quantity as sufficient if the ground is in good order. They can be sown with the wheat drill; but I decidedly prefer sowing broadcast, as when drilled the weeds are liable to start between the drill rows.

If oats are to follow corn, do not plow the land, and if to be sown on wheat stubble, plow in the fall. Then in the spring work the surface mellow to the depth of three inches, and finish with the plank drag, and you will have the best possible seed bed both for oats and grass. If your land is level, the oats may be sown before any work is done; but if it is uneven, give it one working before sowing. The Randall harrow is the best implement I ever used for this purpose; but a good seed bed can be made by the use of the double or single cultivators, and by cross-harrowing with a heavy harrow, always finishing with the plank drag.

The advantages of this plan are, 1st, that it is rapid. I can, with a Randall harrow and plank drag, put in well from three to four acres a day with one team, while, if the land must be plowed, it would take more than two days. 2d. You can work the surface of a field a day or two sooner than you can break it, as it is dryer at the surface than a few inches lower. 3d. And most important of all, it gives a better start and crop than to break the land. Probably my statement will be received with incredulity by many of our readers, and it is possible that the same results would not follow on all soils; but it is a matter that

each farmer can easily test for himself by seeding a land as I recommend, and comparing it with the remainder of the field. But if you do this, do not omit the use of the plank drag, for I think the advantage of this method is due largely to the fact that we get the surface mellowed than when the land is plowed.

Barley.—Less than one-eighth as many acres of barley are grown in the United States as of oats; fourteen States do not report any. The general treatment of the crop is the same as for wheat. Two bushels per acre is the amount of seed usually sown. Fall or winter barley is generally sown in August or early September, and spring barley as soon as the land can be worked. To grow a profitable crop and good quality of barley, requires rich land, and good corn land is also good barley land. The most profitable crops are grown on bottom lands and under-drained black land, and occasional yields of from thirty-five to fifty bushels per acre are obtained on such lands, and when high prices prevail, these crops are exceedingly profitable. The average yield of barley is, however, only about fifty per cent above that of wheat, and although there are occasional years of high prices, I think the average price is considerably less than that of wheat.

There are some disadvantages connected with the barley crop, which should be considered in deciding whether to grow it. 1st. It requires the best land. 2d. It fluctuates more in price than other grains, the demand being limited to what is needed for brewing, no other use to any extent being made of it in this country, and a good yield often brings down the price, so that it is not as profitable as wheat. 3d. The crop is easily damaged, and greatly reduced in value when in shock, by a rain which would not injure a wheat crop at all. 4th. It has more enemies to contend with than the wheat crop. Being sown earlier, it is often injured by the Hessian fly, and of late years large breadths of it have been destroyed by a worm, which climbs the straw and eats off blades and beards before the crop has matured. 5th. The crop being used almost exclusively for the production of intoxicating liquors, its production involves a question of morals.

Rye.—I have not ordinarily found it profitable to grow rye for the grain, yet I place a high value on the plant, and recommend that it be grown for some purpose on every farm. Under the head of "Green Manures" I have treated of it as a fertilizer. I can also heartily recommend it for pasture. From causes beyond his control, the farmer often fails to get a stand of grass or clover in the spring, and his rotation is broken up, and perhaps, unless he can find some substitute for clover, he would be obliged to sell stock which he would gladly keep. By seeding a field with rye and timothy in September, he is sure of early and profitable pasture the ensuing season. The rye will be ready to turn on, earlier even than blue-grass, and will produce a large amount of palatable and nutritious pasture, and by the time the rye begins to fail, the timothy will take its place. Until I had tested the matter, I supposed the young grass would be much injured by tramping while feeding off the rye, but I find that it is not. Nearly or quite a month can be added to the grazing season by the use of rye for pasture, and that at a season when stock are hardest to keep in flesh. The farmer who has a rye field for early pasture is not tempted to turn his stock out so early on the clover or other pastures, and is likely to have better pasture all summer on account of it. If it is the intention to leave the field on which rye is sown for pasture another year, I would recommend that clover also be sown in the spring. Turn the stock on this as soon as the growth is sufficient, and keep them there till the middle of May or till the clover begins to show the blossoms; then take off the stock and allow the rye to grow, and it will make a light crop of grain, and the grass will come on for good late pasture.

Rye straw may be grown for sale with great profit by farmers living so near a city that they can wagon it to market, or those living remote might grow it in such quantities as would justify them in baling it, for the railroads will not transport it in bundles. I have watched the market reports for several years, and often find it quoted as high as the best qualities of hay. I have grown rye for the straw alone for some years, cutting it when in blossom, but have never weighed it to see what the yield

was per acre. In response to an inquiry of mine in the *Country Gentleman*, a gentleman from Pittsfield, Massachusetts, reported that he grew two crops in 1874 and 1875 for the purpose of testing this matter. With both these crops the grain was allowed to ripen. The yield of clean straw was four tons to the acre in the first case, and four tons and five hundred and forty-eight pounds in the second. If I were growing the crop for the straw, I would not allow the grain to ripen, but cut as soon as the blossom fell. By this means we save the expense of hand-threshing, and get a heavier and better article of straw—advantages which fully compensate for the loss of the grain.

Besides, in removing the crop so early, a good growth of grass or clover will be made if it was seeded down; or if otherwise, the stubble can be plowed and another crop grown. I see by my diary that I have generally cut my rye for straw in May, and in early seasons as early as the 19th. This early-cut straw is an excellent substitute for sheaf-oats, to cut up for chop for horses, as it is soft, clean, and free from dust.

I think a piece of poor land could be made to yield a good profit, and be very rapidly improved in this way, if clover was sown with the rye, for cutting the crop so early would give the clover time to develop, so that when plowed down it would greatly benefit the land. I find no trouble in curing this green-cut straw. We bind in small bundles, and shock loosely in moderate-sized shocks, and when partly cured, put two shocks together. I should confidently expect over a ton to the acre the first season on land so poor that it would not pay to cultivate in corn or wheat, and this ought to be at least doubled after plowing down a clover crop or two.

Another purpose for which I greatly value rye is to prevent washing. On our rolling lands we must continually guard against this, and when once a rivulet is started, it is very difficult to stop the cutting down into the subsoil. If we seed with grass alone, it comes up weak, and is likely to be washed out; but if rye is sown with the grass, it strikes root quickly, and protects the young grass and holds the soil till a sod is formed. When rolling fields are planted in corn, it is an excellent plan to sow

rye among the corn early in the fall, to prevent washing during the ensuing winter. There are often barren spots in pastures which do not readily take grass, and remain bare and unproductive. If rye and grass are sown together on these spots in September, and a heavy harrow run over the land till the surface is a little mellowed, the rye will strike root and protect the grass, and enable the farmer to make these unsightly spots disappear.

There is no other farm crop grown that will flourish so well on exhausted land, and none that will bear so late seeding. I have known rye to make a good crop when sown so late that it did not come up till spring. I think it does best when covered lightly, and would always get the land fine and smooth before seeding, and cover with a light harrow or plank drag. When sown for grain, the usual amount of seed used is from three to five pecks to the acre. On rich land, in good condition, I think three pecks will bring a heavy crop. When sown for pasture at least two bushels of seed will be required, and when sown for the purpose of plowing under, as a fertilizer, even double this amount is often employed. The farmer who begins growing this crop will, as he learns its value and the many uses to which it can be put, be likely to continue its growth, and increase the breadth of land devoted to it.

Beans.—An important supplementary crop, and one which is often quite profitable, is beans. The varieties are numerous, and in deciding what to grow the farmer must be governed somewhat by soil and location.

One advantage of the small white bush beans is that they, like rye, will make a profitable crop on an exhausted soil, which would not pay for cultivation in corn or wheat. The crop is one which matures quickly, and is well adapted for planting on land where a crop of rye has been grown for green manure, as the rye can be allowed to complete its growth and be turned under, and the land to become settled before the beans need to be planted. I have found beans an admirable crop to precede wheat, and would rather a crop of them should be grown on the land I intend to seed to wheat than that it should be summer

fallowed. The navy bean is the most salable, and with me has proved best for the main crop. The land should be plowed at least two weeks before planting, and three or four weeks is better, as it will be cleaner and mellowed. Plant as near the 10th of June as you can, but it is well to have the land ready, so as to be able to take advantage of good weather if it comes a week sooner. Harrow and drag so as to have the land smooth and fine, and try and plant as soon after a rain as the land will work nicely. Beans do not come up well in heavy, wet land, or through a hard crust, or even if you succeed in getting a stand when a heavy rain falls soon after planting; there is likely to be a crop of weeds come up with them, which makes them more difficult to keep clean. I prefer to sow with the force feed wheat drill, using every third tube, which makes the rows two feet apart. Use about three pecks of seed per acre, or if the land is rich, two pecks will be sufficient. I have grown profitable crops without cultivation, but unless the weather remains dry for some weeks after planting, the weeds and grass are likely to start and smother the crop if not cultivated. Begin the cultivation soon, and let it be shallow, so as to keep the land level, as earth thrown to the plants will be likely to injure the beans in the lower pods and reduce their market value. Keep them clean, and they will ripen more regularly. Besides, if you intend to follow the beans with wheat, it will be better to sow the wheat without plowing, and you can not do this if you allow the field to become foul. The crop will be found an easy one to cultivate, as it will soon shade the land and prevent the growth of weeds.

The critical time with a bean crop is the harvesting, as if wet weather causes some of them to turn black, the whole crop will need to be picked over by hand before they can be sold, and this is a tedious and expensive job. It is best to pull them before the pods are dry, as if too ripe they are likely to shatter and waste. The best time to pull them is when half the pods are yellow; but when there is danger of heavy frost, they may be pulled perfectly green and cured in the barn. If thus gathered and spread thinly on open floors, they will make the bright-

est and handsomest quality, even though pulled before the beans are fully grown, as the sap in the stalk will fill out and perfect them.

When you pull the beans lay several rows together so as to leave room to drive between with the wagon to gather them up; lay them roots up, as lightly as possible, so that the air can circulate through them, and in a day or two carefully turn them with a four-tined fork. As soon as dry enough, mow them, and if they can be put on temporary scaffolds, with rail or pole floors, it is better, as this gives a circulation of air, and enables you to safely put a larger bulk together. I think it will pay on farms where beans are grown regularly, to provide some stakes for stacking the beans, so as to cure them in this way, as it is much safer than to leave them on the ground. The stakes should be smooth and sharpened at both ends, the lower end so as to set them in the ground, and the upper end so that the beans can be slipped down from the top, and they should not, when set, be over six feet high, or it will be difficult to reach the top to put the beans on. Four sticks of stove wood laid across each other on the ground will keep the vines from the damp, and a large amount of beans can be crowded into a stack two feet in diameter and six feet high, and by a little care in arranging the top no water can penetrate it. I think there is no way in which beans can be cured so safely in a wet season. The stakes must be set deeply, with a good crowbar.

The best way to thresh beans is to tramp with horses, and the best time is in very cold weather, as they then become very dry, and a few minutes will tramp out a flooring. The one point to be carefully guarded against is thin places, or bare spots on the floor, or the horses will split some of the beans, injuring their appearance and sale.

Broom-corn.—To the farmer who has a soil well suited to the crop, who understands how to manage it, and who grows it regularly, broom-corn will generally prove profitable, particularly if he is "fore-handed" so that he can hold the crop over in years of low prices; but the man with a heavy clay soil, or foul land, and without experience in handling the crop, who is tempted

to plant it by the success of a neighbor differently situated, usually pays dearly for a little experience, and abandons it in disgust after growing one crop. It is a crop requiring a great amount of labor, and one which fluctuates so much in price that if you must sell each year, you can never calculate with certainty as to whether it will be profitable or not. I have before me the prices at which the brush sold in New York, extending over a period of five years, and the range is from \$40 to \$300 per ton. About six hundred pounds per acre is an average crop, and I should put the minimum cost of growing and preparing for market at \$15 per acre, including rent of land, and probably the average would be \$20, so that it is easy to see that at the lowest named price it would be a losing crop. These low prices are always, however, for poor brush, that on which the seed has been allowed to ripen, or which has lain out in rains, or been put in the barn too green and allowed to heat in the mow. In proof of this, I will state that in the same years that brush was sold at \$40 per ton, the lowest price paid for good green brush was \$200, and the average price for this quality of brush for the five years was \$224 per ton. These prices show how important it is that the farmer who grows broom-corn should understand the business and be prepared to take proper care of the crop. While the seed has considerable value as food for stock, it does not pay to allow it to ripen, as the value of the brush will be reduced far more than the seed is worth.

There are not many varieties of broom-corn. The dwarf grows but three or four feet high, and produces a fine brush, but it is difficult to harvest, and as the brush does not grow out of the sheath of the upper leaf, but is partly inclosed, it is often, in wet seasons, damaged by the water running down in the sheath and rotting the brush. This variety is but little cultivated now, and only for the purpose of making small brooms, whisks, and brushes for clothes. The common variety is locally known by different names, as early Mohawk, Shaker, and early York. It is a good variety, but if not cut early, before the seed begins to ripen, it turns red, which greatly reduces its market value. The Evergreen, called Missouri, and also Tennessee, is the

standard variety. It is of large growth, on rich land often attaining a height of twelve to fifteen feet, and yielding a long, fine brush, which retains its green color till the seed ripens.

Broom-corn will do best on a warm soil, either sandy or a black loam, for it is of very slow and feeble growth early in the season, and on wet, cold land it will require a great deal of labor to keep it clean. For the same reason I recommend that planting be deferred till the land and weather are warm enough to give it a good start. I advise, however, that the land be plowed either in the fall or early in the spring, as this will enable you to get it clean and mellow before planting time. Great care should be exercised to get good seed, and have it in perfect condition. To secure good seed select a spot in the field on which the brush is of the best quality; leave this until the seed is thoroughly ripe, then cut; carefully select the finest brush, which tie in bunches, and hang in an airy place to cure. Just before planting swim the seed, and reject all that floats. In this way good, heavy seed that will start strong and grow vigorously can be obtained. I have often secured less than a gallon of such seed from a bushel of the ordinary sort.

Broom-corn will bear much closer planting than Indian corn. If the land is very clean the crop may be drilled, but otherwise I would recommend hilling. The rows should be about three feet apart, and the hills not more than two feet in the row, with from six to ten stalks to a hill. In dropping use only the thumb and forefinger, and you will soon learn how to drop the right amount. This matter of seed, and taking pains to drop just the right amount, is one of great importance, as thinning is one of the slowest and hardest jobs connected with the management of broom-corn. Some writers recommend a teaspoonful to the hill, to allow for bad seed. It would be cheaper to pay ten dollars a bushel for such seed as I recommend, as two quarts of it will be sufficient for an acre, and no thinning will be necessary. If the land is in such condition as it ought to be the seed can be covered with a light harrow or plank drag, but the covering should be light—not to exceed an inch.

One favorable quality of this crop is that it may be grown

for many years on the same land without change, and, with proper care, the land can be so thoroughly cleansed that the labor of cultivating will be greatly lessened, as the crop soon shades the soil so that weeds have but little chance to grow. The double cultivators, with fenders, are used in its cultivation, and by means of these we can cultivate it when quite small, and get close to it without danger of covering it up. Unless the land is very clean, and the season unusually favorable, it will be necessary to hoe it, and this should be done thoroughly, putting enough fresh, mellow earth round each hill to smother out any weeds or grass that are starting.

Harvesting.—If you expect to produce brush that will bring the highest price in the market your help must be engaged both for cutting and scraping, and your racks prepared in barn or shed for curing the brush, for a delay of a week may reduce the price so as to cause a loss far greater than the entire expense of cutting and preparing for market.

The most successful growers recommend that the cutting begin as soon as the blossom falls, as the brush at this time will not only have the best color, but also the greatest weight. The first operation in harvesting is to “table” it, by which is meant the breaking of two rows at about two feet above the ground, and laying them across each other at such an angle that all the brush shall project into the spaces between the tables far enough so that when cut the “table” will stand, and be strong enough to bear the weight of the brush. In tabling the man walks backwards, breaking two rows at a time, and the angle at which the stalks are laid down will depend somewhat on the height of the stalk—the longer the stalk the greater the angle. A little experience will enable any one to make a good table if he will keep in mind the two points that the brush should all be in the spaces at the side of the table, and the table so that it will stand firm after the brush is cut. In cutting grasp the brush with the left hand, taking care not to catch the leaf; place the knife against the stalk, about eight inches from the brush, and draw with the left hand, the object being to sever the stalk and draw it out of the sheath without removing the blade. If a

blade occasionally comes off with the brush it must be taken off, as it would be likely to cause the one who holds it on the cylinder in scraping to lose his handful. A little experience will soon enable one to know at what angle to hold the knife, and how to manage that he may do the work properly and rapidly.

The brush from two or more tables can be laid on one, so as to leave room for the wagon to pass through to take it to the scraper. The scraping is usually done with small machines run by one or two horse power, either tread or sweep. A small cylinder like that of a threshing-machine is used, but the concave is removed, and it is run from the operator instead of towards him, as in threshing. A board eight or ten inches wide, with circular notches cut in it to protect the hands and keep them from being drawn on to the cylinder, is placed within a few inches of it, and leaning slightly towards it. One or two boys gather up the brush in handfuls of the proper size, and hand them to the man who scrapes. He holds these bunches on the cylinder, resting his hands against the board, turning the brush until all parts are freed from seed. It is a matter of considerable importance to keep the brush straight in bringing it from the field, and I usually bind with rye straw, as it can be handled much more rapidly than when taken in loose.

If the farmer expects to make a business of broom-corn growing it will pay him to build a shed for the purpose of curing it, and one similar to that described in the wheat chapter will answer, and could be used for both purposes, as the wheat can be threshed before the broom-corn is cut. A building the size that I suggested (twenty-five by forty-eight feet, with posts sixteen feet high) would furnish room for thirty-five to forty acres of broom-corn. A building for this purpose should be provided with ample ventilation by hanging every fifth or sixth board with hinges, so they can be opened in good weather and closed during stormy weather. Racks must be provided for curing the brush, so arranged as to allow a free circulation of air, and at the same time to allow access to all parts of the building to examine and turn the brush. When green it is advisable to only

put it two or three inches deep, and as it becomes partly dried it can be condensed, and the racks filled to a greater depth.

In scraping the crooked brush should be separated from the remainder, as if it is mixed through with the good the price of the entire lot will be decreased. If one is growing but a few tons it can be marketed in bundles, but it is a decided advantage to bale it. Any hay or cotton-press can be used for the purpose, and, where the crop is small, any one with mechanical skill can devise a press that will answer. The standard size for a bale is three feet ten inches long, two feet wide, and thirty inches deep. The bale is secured with four or five wires, that known as No. 9 fence-wire being suitable for the purpose. Such a bale will weigh about three hundred pounds. All crooked brush should be baled by itself, and pains should be taken to have the bales present a good appearance, with the butts even, and nice straight brush used for the outside. Above all, have the bale strong and well secured, so that it will not become rickety in handling. It will pay to secure the services of an expert till you learn how it is done.

I would advise that the inexperienced farmer who wishes to grow broom-corn begin on a small scale till he gains some knowledge of the business. A crop of say ten acres can be cured in an ordinary barn, and, after learning how to handle the crop, a larger area can be devoted to it, if desirable. I would not burn the stalks, but would harrow them down when dry with a heavy harrow, and turn them under with a three-horse plow, with a rolling cutter and weed-hook. It will often pay to cut and draw several acres of them to the barn-yard. They can be cut with the mowing-machine if the ground is level, but, even if cut with a brush-scythe, it is not expensive.

Making Brooms.—Although the manufacture of brooms is a separate business from growing the crop, it is largely carried on by farmers, and as it does not require expensive machinery or much mechanical skill, and furnishes lucrative employment in-doors for the winter season, it is well suited to small farmers, who keep but little stock and so have some months in winter that can be spared from the labor of the farm. All the

machinery needed for the business can ordinarily be had for twenty-five or thirty dollars, and a very short apprenticeship will enable one of any mechanical skill, to learn the trade. I think that in a month one ought to be able to do a full day's work and do it well. Five to six dozen common-sized brooms are counted a day's work. When brooms are made by machinery the work is not severe, and can be done by women, and I wonder that there are not more of them engaged in this work, which opens to them an avenue to an independent living, as from six to ten dollars a week can be made at it, and I think the labor less severe than bending over the wash-tub.

Buckwheat.—In our best grain growing States buckwheat holds an insignificant place. In Ohio, for example, we grow more than three hundred dollars' worth of wheat for each dollar's worth of buckwheat, and the average yield per acre is about twelve bushels. The Southern States do not grow it at all, and New York and Pennsylvania produce nearly two-thirds of all grown in the United States, New York alone producing in 1880 over five million bushels in a total of less than fifteen million. I find that buckwheat will not fill till the nights are cool, and so defer sowing as late as is prudent, and in my latitude I have grown the best crops when sown the first of July. The land should be in good condition, free from weeds, and mellow. From two to three pecks of seed are sown to the acre, covered lightly and rolled. When cut, we stand it up in small bunches, with the tops twisted together, and do not bind it. We thresh by tramping with horses. There are some incidental advantages connected with the crop, as it furnishes bee pasture at a season when other bloom is scarce, and it has a good mechanical effect on stiff soils, and like clover, by its dense growth and shade, smothers out all other growth. I have succeeded in getting a good stand of grass when sown with it on thin soils, but on rich land it grows so rank as to smother out all the grasses. I do not think it an exhaustive crop, but corn usually does not succeed well, when following it.

Pumpkins.—I know that the chemist places a low feeding value on pumpkins, but I find them a crop of considerable

value for all kinds of farm stock. Fattening hogs will eat a good-sized pumpkin each per day and thrive better than if on an exclusive corn diet, and either milch or fat cows thrive well on them. Most horses will eat them readily, and are greatly benefited by them.

There is a popular idea that it is necessary to remove the seed when fed to milch cows or the flow of milk will be diminished. After careful experiment I conclude this is an error. I have tried feeding both with and without the seeds, and could see no difference, and I once had a cow eat a half bushel of seeds which I had taken out and left in a tub, and she gave for the next two milkings an unusually large mess, and was not at all injured by the feed. I prefer to grow this crop by itself rather than in the corn field. A profitable crop can be grown on quite poor land, if manured well in the hill. They may also be grown after a crop of clover hay has been cut, or as a second crop, following early potatoes. When they are to be grown after early potatoes it is best to omit the planting of every fourth hill in each third row of the potatoes, and then about the middle of June plant these vacant hills with pumpkins. The potatoes will be ready to dig by the time the vines need the land. I prefer the Connecticut field or Yankee pumpkin for stock, as they are softer fleshed and can be eaten readily by cattle without chopping, while with the thick fleshed, solid varieties, it is necessary to cut them.

Flax.—Flax is not ordinarily to be ranked among the profitable crops of the farm. It is exhaustive, ranking in this respect next to tobacco, and farmers who have had large experience with it say that it should not be sown on the same field oftener than once in five years, and that eight is better. The crop will rarely pay, unless the farmer is so situated as to have a convenient market for the fiber, as well as the seed. The average yield of seed per acre is probably below eight bushels, and the land must be both rich and clean, and the seed-bed thoroughly prepared if the crop exceeds twelve bushels. In very rare cases fourteen to sixteen bushels have been grown. The yield of fiber is from eight hundred to one thousand five

hundred pounds. The average price of seed is from one dollar to one dollar and twenty-five cents per bushel, and of fiber from six to thirteen dollars per ton. The straw is of little value on the farm, as it is difficult to rot it for manure, and it is not safe cattle food, as it produces abortion if fed to cows in calf. Flax straw is excellent for making temporary shelters for hogs or cattle, or for stopping washes on rolling land, as it is very lasting. Grass or clover may be sown with it, and will do well; but as a flax stubble gives an easily prepared seed-bed for wheat, and the latter crop usually does well when sown after flax, it is best to plow the flax stubble for wheat.

CULTURE.—The soil for flax should be rich, as it will not pay to sow on thin land. It should also be clean, as weeds among the crop make it hard to cure and also reduce the yield. The land should be thoroughly prepared and made fine and smooth. It is useless to expect a profitable crop if sown on a rough, cloddy surface. The land should be harrowed and rolled until as fine as a garden, and the seed should be covered very lightly. It may be covered with a brush or light plank drag, or a sloping-tooth harrow. On a good soil well prepared, one-half bushel of seed is sufficient when seed is the object sought, but if sown with special reference to growing fiber, from one to two bushels is used. If the day is windy it can be sown with the drill, but should not be run through the tubes, as this would not scatter the seed enough, and would cover it too deep.

The best directions as to time of sowing, is that it be put in between oats and corn. If sown as early as oats are usually put in, it will be in danger of being killed by frost, or if heavy rains fall, of being unable to come up through the crust, or if it came up, weeds would start with it and damage the crop.

The crop is ready to harvest when a majority of the boles are ripe. It can be cut with the self-rake reaper, and a few days curing will fit it to be threshed. This is often done with machines, but usually it is tramped with horses. If the farmer has room to store it, it is best to defer threshing until cold weather, as it is a dusty disagreeable job. It is quite common to smooth off a place in the field and tramp it on the ground and

sometimes a common field roller is used in threshing it, the circle being made large enough so that the horses can draw the roller over it. When threshed in the field it should at once be cleaned up, or if left over night should be piled and carefully protected from possible rain.

Cotton.—The cotton belt of the United States extends from the Gulf to the fortieth parallel of latitude, but between 36° and 40° the crop is often cut short by a cold wet spring or early autumn frosts. There are three classes of soil on which the plant flourishes. First, the soft limestone, or what is called the rotten limestone and red lands, which are found in Georgia, South Carolina, parts of Alabama and Mississippi, and a small part of Texas. Second, the rich, black, cane-break lands of middle Alabama, and the black, rolling prairies of Texas. These black lands can not be surpassed for the certainty with which they produce crops, their freedom from insect enemies, and natural drainage. The third and most valuable class of lands are the river bottoms, as they possess almost unbounded fertility, and being made up of vegetable mold and sand are easily worked and dry off quickly after heavy rains.

Mules are better than horses for working the crop, as they endure the heat much better. The usual allowance of help is one mule and one hand for each ten acres of cotton, but in the picking season, extra help will be required. Plowing begins early in February, and the land is plowed into beds from four and a half to seven feet wide, the richer the land the wider the rows. Many careless cultivators simply lap the furrows together, leaving the soil unbroken underneath, but the better way is to first plow out a furrow and then turn the soil back so as to give a greater depth of mellow earth. It is desirable that this plowing should be done several weeks before planting, so as to give time for the weeds to start, which will then be destroyed by the harrowing, laying off, and planting, and also because a mellow seed-bed can be made after the land has been settled by rains.

The planting season begins the middle of March and continues till past the middle of April, but the chances for a good

crop are much better from the early planting. It is important that the rows should be straight and narrow, and as cotton seed should not be covered deep, the furrows should, also, be shallow. The "sled-marker" which you will find illustrated in our chapter on corn culture, would be admirably suited for the cotton field. It is customary to use a much larger quantity of seed than is necessary, and then thin the plants, as it is cheaper and better to do this than to run the risk of a poor stand.

As soon as the plants show the third leaf, cultivation should begin. A light plow should be run as near the crop as possible, and for this purpose the double bar plow, with rolling cutters for fenders, can not be excelled. Then the hoe gang follows and chops out the surplus plants so as to leave bunches from twelve to thirty inches apart, according to the condition of the soil, and later these bunches are thinned by hand to two plants, the wider spaces being on the richer land. The cultivation should be thorough and constant till the plants interlock across the rows.

The picking season begins in August and lasts till nearly Christmas. The work, while not heavy, is exceedingly monotonous and trying, particularly late in the season. Writers on cotton raising say that this work can not, and never will be done other than by hand, but during the autumn of 1883 I saw the statement that the first bale of cotton ever picked by machinery had just been sold in New Orleans. In picking, the seed cotton is deposited in wide-mouthed sacks that are hung around the neck; and as about twenty-five pounds is as much as the picker can conveniently carry, it is best to have drive-ways through the field at suitable distances. The cotton is transferred from the sacks to four-bushel baskets. During the picking season, and especially late in the season there is great danger of sickness among the hands, as the mornings are cold and chilly, and humanity, as well as self-interest, should prompt kind treatment for the help. It will be found a good investment to furnish hot coffee and quinine. The best time to sort and trash the cotton is before storing in the gin-house. This work can be done by hands not strong enough for regular field work.

The cotton is assorted into four grades: 1st. The fine, long-stapled cotton, clean, dry, and silky. Early pickings will yield a large per cent of this quality before the time of frost and heavy fall rains. 2d. Short, kinky bolls that have been bored by the boll worm, or late and killed by the frost, or that which has been grown with excessive or irregular moisture. 3d. Trashy cotton, mixed with broken leaves and stems, after heavy frosts. This is what causes the black specks in the coarser grades of muslin. 4th. Dirty cotton which has been beaten down by rain and wind, and mixed with sand and earth.

The best grade should never be allowed to become damp from dew, and should lie a month or more before ginning, as the oil in the seed ascends into the fiber, increasing the weight and giving a fine pale straw color.

The less cotton is handled the better, and a wagon should be arranged so as to receive the baskets instead of emptying them into the wagon bed.

It takes over four pounds of seed cotton to make one of ginned. Ten good hands can pick enough to make one bale a day, and the average weight of a bale is about five hundred pounds.

GINNING.—The plantation gins are usually run by horse-power, but sometimes by steam. The principle of the cotton gin is simple. A wooden cylinder four feet long, and five inches in diameter, is provided with circular saws nine inches in diameter. These saws are set one-half inch apart, and project two inches from the cylinder, which revolves from the operator. The saws revolve between steel bars set so close as not to allow the seed to pass, but the teeth carry the cotton through. Below the saws a set of stiff brushes revolve in the opposite direction, and brush off and clear away the lint from the saw teeth. A fan is also arranged to furnish a blast of air to carry the lint to a convenient distance from the machine. These are the three essential points of the cotton gin.

Cotton must be dry to gin well, and a scaffold should be provided for drying that which is damp. This scaffold should adjoin the gin-house, and should have a canvas roof which can

be rolled up so as to admit the sun, or let down quickly on the approach of a shower.

The baling should be thoroughly done. There is great loss every year from bad baling, which necessitates rebaling at New Orleans at a cost of one to two dollars a bale, and, also, largely increases the cost of transportation, as a well made bale will occupy from one-third to one-half less space than when badly done. Hoop iron has largely taken the place of rope for holding the bales together.

From the brief description given, it will be seen that the cotton crop keeps the hands busy nearly the entire year, the plowing beginning in February, and the picking ending in December, and then the ginning and baling must be done before plowing for the next crop is begun.

INSECT ENEMIES OF THE CROP.—These are the Cotton Louse, Cut-worm, Cotton-worm, or Moth, Army-worm, and Boll-worm.

The first is a small, gray louse that attacks the plant, and is usually found on cotton growing on a wet or unsuitable soil. The remedy is, first, careful culture, which will give a thrifty plant, and, second, dusting with ashes and plaster.

The cut-worm is familiar to all farmers. Ashes or lime around the roots of the plant is found to be a good preventive of its ravages.

The cotton-moth appears in August, and, as they are at first few in number, would occasion no alarm to the uninitiated; but it sometimes happens that the worms hatch in countless millions, and in three days they have been known to eat every leaf from a thousand acres, leaving no possibility of more than an eighth or tenth of a crop. If the crop is to be saved there must be no delay in fighting this enemy. There are two methods: one is to make war on the moths, and destroy as many as possible before they lay their eggs; the other to hunt their nests on the leaves, and destroy them.

For the first, let the hands go out early in the morning with paddles made from wide shingles, and as the moths rise strike them down and destroy them. Another method is to trap the moths by placing plates on boards secured to stakes, on which

is a mixture of molasses, vinegar, and cobalt. This attracts the moths, and they stick in it and perish. White cotton flags, a yard square, are sometimes used, which allure the moths, and they deposit their eggs on them. The nests of eggs must also be destroyed, and fortunately they are easily found, as the moth cuts the midrib of the leaf, and ties it down with a thread to protect the eggs. These insects eat nothing but cotton, and when they appear in countless numbers they provide for their own destruction, for they consume every leaf on the field, and start feebly for another, but they can not surmount ditches and fences, and the hot sun kills them, and in two days from the time the crop is eaten up not one of the army may be found alive.

THE ARMY-WORM.—This differs from the cotton-moth in appearance and habits, and is not so difficult an enemy to fight. Its voracity is equal to that of the cotton-worm, and it consumes all green crops that come in its way. It is longer lived than the cotton-worm, can travel much faster, and overcome greater obstacles. The most effective obstacle to its march is a clean-cut ditch, which need not be deep, but should have a perpendicular side next to the field to be protected. The worm travels from south to north, so that you may always know which side of the field to begin to fortify. As a rule, the planter will hear of their approach in time to open the ditch. They will often come in such numbers as to fill the ditch and pass over, so it will be necessary to be ready with all the force to guard the field. A log dragged back and forth in the ditch will destroy them. When they are so near, or approaching so rapidly, that there is not time to complete the ditch, their progress may be retarded by scattering a line of straw and setting fire to it.

THE BOLL-WORM.—The-boll worm is an annual pest. It begins work as soon as the bolls are formed. It never destroys the crop, but pierces three or four, and sometimes as many as ten, bolls, nearly, or quite, killing them. The natural food of the worm is corn. The moths pair early in July, and four days later the female deposits on the silk of the growing corn about seven hundred and fifty eggs. The worms hatch in three days, and feed for two weeks on the corn and silk. It then goes into

the ground to the depth of three inches, is transformed into a chrysalis, and in sixteen days reappears as a moth. By this time the corn silks are dead, and this second crop of moths deposit their eggs in the cotton buds. If hot, dry weather follows most of the eggs perish; but if cloudy, moist weather prevails, they will be more numerous.

The remedies suggested are, first, having no corn near the cotton field, and allowing the latter to lie fallow a year, which will destroy most of the eggs; second, planting a small field of late corn near the cotton, or a row every thirty feet through the cotton field, as the miller will not deposit its eggs on the cotton if green corn is convenient.

DISEASES.—There are some diseases to which cotton is subject, but for all of them the best remedies are thorough cultivation, as they are usually caused by defective drainage or cultivation, or an exhausted soil. The crop is rarely destroyed by any of them, although it is often cut short. These diseases are called the “sore shin,” the red and brown rust, the dry rot, and the “cotton blues,” and there is no specific remedy for any of them. None of them are feared by the planter with a good soil which is well cultivated.

COTTON-SEED AND ITS USES.—From each bale of cotton there will be produced about fourteen hundred pounds of seed. Until about 1850 this was considered a waste product, and was left to accumulate in great piles about the gin-houses. About 1855 several of the largest linseed oil mills of the country were converted into cotton-seed oil mills. The first oil made was of a dark-red color, and was used for burning in lamps; but the oil refiners soon discovered a cheap and simple process of refining it so as to make an oil of a rich olive color, sweet and agreeable to the taste, and it is largely used as a substitute for olive oil for culinary purposes. The oil is also largely used for the manufacture of soap, although the first experiments were not successful, as the soap, after being kept a few weeks, would exude a dark, gummy liquid, which rendered it unsalable. When mixed with petroleum it makes a fair lubricating oil, and painters have used it to some extent.

COTTON-SEED MEAL.—After the oil has been expressed the cake is ground and sold for stock food, under the name of cotton-seed meal. Both chemists and dairymen claim for it a superiority over linseed meal. The great bulk of it is exported to England, where it commands good prices—sometimes above forty-five dollars per ton—and is used by dairymen and stock-feeders. Its use is also increasing in this country, so that what but a few years ago was considered valueless is now worth to the planter several millions of dollars per annum.

To show the value of cotton-seed meal as compared with linseed, I copy the following from Professor Voelcker as his opinion after making an analysis of several specimens of cotton-seed meal: "1st. The proportion of oil in all the specimens is higher than in the best linseed cake, in which it is rarely more than twelve per cent, and ten per cent may be taken as an average. As a supplier of food cotton-seed is, therefore, superior to linseed. 2d. The amount of oil in several specimens differs to the extent of $5\frac{1}{2}$ per cent, the lowest being 13.50 per cent and the highest 19.19 per cent. 3d. Decorticated cake contains a very high and much larger percentage of flesh-forming matters than linseed cake, and it is, therefore, of great value as food for young stock and milch cows. The dung is also very valuable. 4th. In comparison with linseed there is much less mucilage and other respiratory matter in cotton cake. This is compensated by a larger amount of oil. 5th. The proportion of indigestible woody fiber in decorticated cotton cake is very small, and not larger than in the best linseed cake. 6th. It may be observed that the ash of cotton cake is rich in bony materials, and amounts to about the same quantity as in other oily cakes."

Sorghum.*—This plant, after twenty years of constant cultivation in this country, is now so well understood by all scientific men and chemists, it hardly seems necessary for a moment's time to be spent by any writer in giving further information to this class of men. But capitalists, farmers, and laborers should be

* Contributed by HENRY TALCOTT, President of the Ashtabula County, Ohio, Sorghum Association.

taught its value, its adaptability to our soil and climate, its strength and importance as one of the factors which might be used to help increase our nation's wealth. And he who can impart information that will help to quicken this grand result, and then refuses or neglects to do so, is a debtor to his fellow-men. We enjoy the watchful care of a good government, its constant protection to life, liberty, and property. Its prosperity as a nation is ours as individuals, and duty bids us all to contribute according to our ability for the nation's good.

It will be my purpose only to give practical information to the class of men before mentioned, in order that the cultivation and manufacture of sugar and molasses from sorghum may become one of the main industries of the land. Sugar and molasses can truly be called the staff of life, for with our American people at present prices it costs them more than bread. Our nation pays to foreign lands over one hundred million dollars annually for the sugars we import, every dollar's worth of which, with our present information, should be made at home; and this can be profitably done, providing farmers and others will give heed and learn the business. My instruction may appear to some too complete and perhaps superfluous; but you must have charity, and remember all are not profoundly wise; and they who need this information most perhaps may not belong to the fortunate class.

Sorghum can be profitably grown in any climate or soil that will produce good Indian corn, and it will stand more heat and drought, and flourish equally well. Its cultivation and harvesting costs no more when properly done. Early varieties can be selected that, in the Middle and Northern States, will mature in from one hundred to one hundred and twenty days; and when the seed is nearly ripe or in good stiff dough, the stalks or canes will make good sugar, and will continue in that condition many weeks—from six to eight at least. Our factory, in 1882, worked, from the same field, cane from the 3d of October until the 11th of November, and it would have been equally good both earlier and later. In the Southern States, a number of farmers have written me that from very early planting they

can secure two cuttings of cane from once planting; and if so, this must certainly be a very important item for any thoughtful business man or company to consider before embarking in the business, unless they are already tied to some particular location. The warm soil of the Southern States will, no doubt, excel the Northern States in its production and manufacture, because all sugar mills or refineries need and must have heat. Hot rooms for granulation of sugar are indispensable. Nothing can be done without them but make molasses.

Warm, sandy soils, that are free from weeds, are good for sorghum, and should be well fertilized to produce the best results. The open or porous soils may not be benefited as much with commercial fertilizers as with clover sod or stable manure; but every farmer should find out by careful experiment what kind of manure will produce the best crops on his own land. On our clay soils we can get the best growth on sod ground; but if the land is old or poor, we add superphosphates, about one ounce to the hill, or from one hundred and fifty to two hundred and fifty pounds to the acre.

The best plan for its cultivation that has come to my notice is to plant in check-rows, three feet apart each way, leaving six to eight stalks in the hill. The entire cultivation can then be done with single-horse cultivators, the same as used for corn, or with the expansive two-horse sulky cultivators that are made by some of our manufacturing companies, that will cultivate crops equally well from three to four feet apart, as they expand or contract one foot or any fraction thereof. These machines, when kept moving through the canes every few days, will keep the ground light and loose, and free it from grass or weeds, and the hills, when this distance apart, will be almost entirely free from suckers. But if you plant in drills, or leave but few stalks in hill, the suckers will grow profusely and rob the soil of your crop, because they are not good for any thing but fodder or food for animals. There is no sugar or valuable sweet in them.

Most farmers who plant but very little of it usually desire it to be made into molasses, and if so, it is very important it be

as thoroughly defecated and freed from the natural raw sorghum flavor as if treated for sugar. And it also pays well and improves the quality of it to strip the leaves from the canes, and cut the seed-tops off with about one foot of the cane. The canes will then make the best and purest flavored sugar or molasses. But in our large sugar mills, with the *almighty dollar* before our minds, we can not be so nice about it. But many things go through the crushers that neither add to its quality or quantity when boiled to sugar.

An acre of land should produce from eight to fifteen tons of the green canes; and farmers should not stop experimenting until they produce this or greater results. The later and larger varieties will produce over twenty tons per acre, but in our northern climates may not mature. The Early Amber cane is sure for all climates, and is the best for main crop. A ton of green canes should yield from ten to twelve gallons of molasses, or about sixty pounds of dry sugar, and from five to six gallons of drainage molasses. The average yield from all parts of the United States seems to be above one hundred gallons per acre, and, therefore, should be worth fifty dollars or more per acre for the sugar or molasses, besides the feed and cane seed. The usual yield of cane seed is about twenty bushels per acre, and when cured, and threshed in a common threshing machine the same as wheat, it is always more valuable than corn for feed to animals, and also good for human food if ground and bolted the same as buckwheat.

If you do n't stop to strip the leaves from the canes, it is no more work to cultivate and harvest a crop of cane than it is of corn, and it will return twice as many dollars per acre for the use of the land. Mine has more than done that for two years past.

The disastrous frosts of 1883 ruined thousands of acres, and remind us that of the affairs of this world nothing can be counted as absolutely certain. Our Jefferson Sugar Factory suffers the most in proportion of any that I have reports from. Three-quarters of our entire crop perished the 9th of September. My own withstood that shock; but the cold, wet, and backward season retarded its growth so that none of it could get ripe,

and I shall now be forced to make it up into molasses. But the cane is better and worth more than my corn. It hardly seems possible that there will be a repetition of the past season for many years to come. But this should be a reminder to all large sugar companies that it is possible, and in choice of location should have its full force.

There is no doubt but what large sugar plantations in Southern Illinois, Missouri, Kansas and all Southern States will prove more profitable than in the Northern States, but up here it does pay well. There is no arbitrary rule to be laid down for its cultivation, and the suggestions here made are intended to apply only where farmers have no better way. The farm tools you now have on hand to work with, as well as the surrounding circumstances, must determine the best method for you to pursue, but the main thing is to cause it to be done, no matter how.

ITS MANUFACTURE.—It is almost incredible that after twenty years of steady cultivation of this plant in our Yankee nation, it should not have been utilized for sugar before 1881. But such is the fact, and with all the wisdom of our agricultural department in Washington, it could not then be placed upon an economical or living basis, while at the present hour the Rio Grande Company, in Cape May County, New Jersey, are manufacturing over ten thousand pounds of dry sugar each day, besides from one thousand to two thousand gallons of molasses. The Champaign Sugar Company, in Champaign, Illinois, and the Sterling Sugar Company, in Sterling, Kansas, are each making about half the amount of the Rio Grande Company, and in addition to these is the Kansas Sugar Company, of Hutchinson, Kansas, that produces daily from twenty to thirty thousand pounds of dry sugar, besides a corresponding amount of drainage molasses. This latter company have now in employ one hundred and fifty-three men in the factory, forty-five teams hauling the canes from the fields to the mill, using up daily about two hundred tons of the stalks.

This business is no longer an experiment, but an absolute success, and only awaits for its development a flow of capital.

The companies I have just mentioned are all stock companies, employing from fifty thousand to two hundred and fifty thousand dollars in capital stock, and the sugar is all boiled in vacuum pans, the same as is used in our sugar refineries, and no one should engage in the business without visiting them to get well posted.

I will describe the Stewart process for the manufacture of sugar in all small mills or by single farmers—which is the plan adopted by the Jefferson Sugar Manufacturing Company of Jefferson, Ohio,—and this can be made universal and profitable on a small or large scale, but for extensive works we advise the use of vacuum pans, for it is a safer process and less expensive. The heat then never needs to rise above one hundred and sixty degrees, but to finish for sugar in open steam pans or by direct fire heat it must go nearly to two hundred and forty degrees before it is finished, and consequently is more liable to get scorched, and the higher heat will injure the color of both sugar and molasses. Neither can it be evaporated as dry in open pans, but must be allowed to stand in hot rooms when cooked as hard as we dare do it, sometimes for many days before granulation becomes complete, while with a vacuum pan it can often be cooked dry enough and crystalization complete so it can go directly into centrifugal machines, for separation and final finish; but usually, they draw from the vacuum pans into little iron wagons, holding nearly 1,000 pounds apiece, and roll them into a hot room and then let them stand from twenty-four to forty-eight hours to complete the granulation. The only hindrance to granulation of the sugar in the sorghum plant is the natural acid in the juice, and as this is in no regular amount, no fixed rule could ever be adopted, but the juice must be brought to proper condition by a chemical test.

The crushers to be used in any mill must be determined by the amount of work you desire to do, but all kinds used should press the canes dry enough so they will be fit to burn for fuel direct from the machine, and if this is not accomplished with once running through the crusher, it should be done the second time and made to do it, or else you may rest assured you are

wasting juice. You will need in addition to the waste cane bagasse, about one-third or one-half as much fuel as you would naturally use to keep up steam without them. But your fireman will object to the use of them, for it is a little harder work and requires considerable muscle as well as grit in the operator to do the job and not grumble.

Arrange the juice pipe from your crusher so you can let it run into two different vessels or cisterns at will, for if you do a custom work in the factory you will desire to know the value of each man's cane delivered to the mill, which can be best done by testing the quantity and quality of the juice; therefore if you have two cisterns to catch the juice, when one batch of cane is pressed, gauge the vessel so you will know the exact number of gallons of the juice. Then with a saccharometer ascertain its density, take the degree mark on the saccharometer for a divisor, and divide sixty by that number, and the quotient will be the number of gallons of that juice it will take to make a gallon of eleven-pound molasses. You can then mix all your cane juice together, and be sure that upon this basis, you can regulate the exact worth of each man's cane, he can not cheat you if you buy upon this test alone, and it is the only sure plan, or truly correct one, for every man should be paid according to the true merit of his produce. The juice should be received through some kind of a strainer to free it from any substance that will prevent its passage through a steam or common pump, and then for convenience and profit, it should be elevated to a reservoir high enough that all the changes and transfers made during the manufacturing process afterwards may finally land the sugar and molasses directly where you wish to pack and ship the goods.

We draw from our reservoir three hundred gallons at a time, into a defecating pan, made of pine plank, eight feet long, forty inches wide, and fourteen inches deep with a skimming arrangement at one end of the pan. This is heated by eight lengths of a three-quarter-inch gas pipe, running lengthwise on the bottom of the pan inside, and the steam let on or shut off with a common globe steam valve. We allow the heat

to raise the juice to one hundred and eighty degrees, then add lime water or milk of lime until it will turn a red litmus paper blue very promptly. We then know by this chemical test that every particle of the acid in the juice is absorbed, and nothing in it to prevent granulation of all the crystallizable portion of the juice.

We let the heat continue until the juice boils at two hundred and twelve degrees, then shut off the steam, and by this time there will be a very thick blanket scum all over the top of the juice, which we immediately scrape off at one end of the pan, made a little the lowest for that purpose. All heavy impurities that are heavier than the juice will soon settle to the bottom of the pan, and the clear juice can then be drawn out at the bottom of the pan by means of a swing pipe, receiving the juice at the top and lowering it steadily with the flow of juice clear to the bottom, or as long as it will run off clear. When it becomes roily, and you get to the muddy sediment, remove that to a deep vessel to settle, and afterwards save more clear juice. The next pan or tank should be of larger capacity than the first, because it may be necessary to have part of two batches in it at once, and just enough lower so it can be drawn from the lime pan easily. In this second pan the defecation is made complete, and here comes the Stewart process, which is very simple, and easy to perform.

There would be a gummy substance surrounding all the little sugar crystals if granulated direct from the lime pan, and it is not possible when so made to separate the dry sugar from the molasses in a centrifugal machine, and for this reason accidental granulation of sugar in sorghum molasses has never been of any account, because it could not be separated. You can not free the juice from this gum and dark color, except by the use of sulphur in some shape or by filtration of it when in thin sirup through animal bone filterers. The latter is quite expensive.

Burning sulphur and allowing the fumes to pass through the limed juice will soon accomplish the work and restore it to a good color, but it is disagreeable to do the work in this way.

Therefore we have a large cast iron retort weighing several hundred pounds, and into this we put sulphuric acid and finely powdered charcoal. Set the retort in a fire arch, and heat it up with fire as soon or before you put in the acid, in order that the acid will not destroy the retort. The sulphur fumes will very soon escape, much stronger than those obtained from burning the common sulphur. We conduct these fumes by means of lead pipes through a series of water casks, four in number, all filled to near the top with good pure water. The water will soon become charged with the sulphur smoke, and after a short time that in the first two or three casks will fail to absorb any more, and its density will then be from three to four by the saccharometer test. This fluid then can be drawn off into other tight casks, and kept any length of time for daily use, and is then what Professor Stewart calls solution B, although the name has no significance whatever. It is simply sulphur fumes confined in water, or sulphurous acid, and is perfectly harmless, and exactly what has to be used by all tropical cane sugar makers in some form or other.

We then take this solution B, and add enough of it to our limed juice until it will turn a blue chemical litmus paper a slight scarlet. We continue the heat by steam pipes, as before mentioned, and the juice will then become clear and a bright straw color. When it can be boiled by steam or open fire it passes directly into beautiful sugar or molasses, and the skimmer must be kept going lively all the time until it approaches good thick molasses.

When defecation of the juice is completed in the second pan it can then be drawn hot from that pan to others, as many in number as your business requires, and the evaporation made as rapid as possible into molasses or sugar, taking care not to cook too large batches at a time, because it injures the color and flavor of the molasses or sugar. Once a day have all your vessels and crusher thoroughly cleaned, and made so nothing will become sour; rinsing with lime-water will leave the crusher sweet and clean. Never crush out more juice than you can boil up each day; or, better still, if you have business enough, run

night and day, with two sets of hands; then no heat is lost, or chance for vessels to become filthy and sour.

The mush sugar can be finished from the good thin molasses—when skimming is complete—by putting a number of batches together in a deeper pan heated by one-inch copper pipes, the same as before mentioned—we have the fourth transfer in our factory for this purpose—and cook into sugar from five hundred to six hundred pounds in each batch, taking about one hour's time from thin molasses. It must then be set away in vessels, in a hot room, kept from ninety to one hundred degrees all the time, when in a few days the granulation will become complete, and it may then be separated in a centrifugal machine, and is ready for market.

The molasses made in this way is worth far more than common sorghum molasses, and is free from that villainous taste, which ruins the trade where the molasses is made without any defecation. We sell ours quickly, where all the sugar is left in, at sixty cents per gallon at wholesale, and it is retailed at seventy-five cents. The sugar brings eight cents very readily, and we can not keep any on hand; our patrons would take twice the amount we are able to make.

Sugar made by this process will not cost over five cents per pound, but with vacuum pans it can be produced for less. These are very expensive, costing from five thousand to twenty thousand dollars apiece, and our large sugar factories must have them to do work to good advantage. It is to be hoped some of the professors who are using these will be patriotic enough to give to the public full and complete instructions for their use, reserving no secrets, but doing the world good by helping to quickly start this industry among our people. I am confident by so doing they will find greater favor with Peter whenever they approach the gates of heaven, and he will be more ready to pronounce their work well done, and they justly entitled to wages.

New varieties of this sorghum plant are being brought out every year, and our markets are being flooded with new machinery, very much of which is absolutely worthless. Many

a manufacturer who has had no practical experience, but has a "bee in his hat," starts a machine, and always thinks it the best; but all who contemplate embarking in the business should learn what they need from the factories that are making a success of it, and not depend upon the word of the manufacturers of machinery at all. Practical men will give you the best instruction.

Tobacco.—In writing briefly, as I must, on the culture of this plant, I am embarrassed as I remember that the experienced tobacco grower does not need and will not profit by what I shall write, and that no one who has not practical knowledge of the crop can learn from a single article enough to enable him to successfully undertake its culture. It is probably the most exhaustive crop grown on the farm, requiring the best land and heavy manuring to produce a profitable crop, and a large amount of labor, and it is unwise to undertake growing it unless prepared to give it the attention required, and at the proper time. While under favorable circumstances a large profit is often realized from this crop, it often, in the long run, fails to be profitable, and if the same labor and manure was devoted to corn, wheat, and potatoes, it would be better for the farm, and often for the farmer.

VARIETIES.—The varieties of tobacco are as numerous as of corn, and, like corn, there are many local names given it. Among the names given by practical writers I find the following: Connecticut seed-leaf, Ohio seed-leaf (the two are probably identical), big Frederick, little Frederick, Orinoco, brittle stem, golden leaf, broad leaf, yellow Prior, Cuba, Spanish white Burley, etc. Some varieties are suited to one soil and some to another, and the inexperienced planter should make careful inquiry before deciding on what to plant.

SEED AND SEED-BEDS.—The seed of tobacco is very small; from careful weighing and counting it is estimated that an ounce contains over eight hundred thousand seeds, and the amount necessary to grow plants for an acre is very small. Some writers estimate two thimbles full, but those most experienced recommend about one ounce for each three acres. If kept in a dry,

safe place, the seed is good for many years, growing as well at seven or eight years old as the first year. This will enable the planter to save seed for a series of years when he has an extra good crop. The greatest care should be exercised in selecting plants from which to grow seed.

The seed-bed should be prepared early, varying with season and locality, from the middle of February to the middle of March. It should be fresh land, and sheltered on the north and west, and a spot is usually cleared along the edge of a wood. It must be naturally drained, and a piece of gravelly land sloping to the south is favorable. If new land can not be had a piece of sod should be plowed in the fall, and heavily manured with manure which has been so prepared that it is positively certain there are no seeds in it that will germinate.

When you find the land dry enough to work, as spring approaches cover the bed with brush and set them on fire, and have brush enough to add so as to keep a hot fire for an hour or more. The object of this is to kill the weeds, as the young tobacco plants will not flourish with weeds, and it is very difficult to pull them out without damage to the plants. After the brush has burned, while the land is still warm, dig the bed up, turning the ashes under, and pulverize and rake till it is perfectly mellow and level. Then sow your seed, at the rate of a teaspoonful to the square rod. As it is so fine it will be necessary to mix it with something to enable you to sow it evenly, and ashes is recommended for the purpose. All the covering needed will be to run a light roller over it or press it with a board. Planters differ as to the amount of land required to produce plants for an acre, some sowing less than a square rod, and others as much as two. The bed should be protected with brush after being sown. If the weather should be very dry it will be necessary to water the bed, and it will be a great advantage to use a small amount of hen manure or soot in the water.

When the plants come up, which will be in from four to six weeks dust frequently with plaster and ashes, as there is an insect called the tobacco fly—which resembles the garden flea—that often destroys them. If the plants are so thick as to be

likely to become spindling, they must be thinned so as to stand about an inch apart. This can be best done with an iron tooth rake, as the plants left will be benefited by the cultivation which the raking will give.

SOIL AND PLANTING.—The best soil for tobacco is a rich, sandy, second bottom, or chocolate colored upland. Black land makes the heaviest growth, but the quality is not so good. The soil should be dry and warm, and contain lime, as this is an important property of the crop. New land is preferable, but any land that grows good corn, wheat, potatoes, and clover will grow good tobacco. If old land is planted, it should have twenty-five loads of manure to the acre. A good rotation is to follow tobacco with wheat and seed with clover, and as the land will be very rich, if the clover is allowed to blossom in the fall before any stock is turned on it, it will make a heavy growth, so that it will furnish a large amount of plant food, and may be turned under in May following, and the field again planted in tobacco. It is best to plow early and give the land several workings before setting out the tobacco, as this will kill the weeds and give a better condition of soil than late breaking.

When the plants have reached the fourth or fifth leaf, and are three or four inches high they are ready to transplant. The planting season varies in different years and localities, and extends from about the middle of May to July. The field is marked off sometimes one, and sometimes both ways, the average distance being about three feet. Small, flat hills, elevated a few inches above the level of the land, are made with hoes, and the field is ready for the plants. If a large amount is to be set, help should be engaged to take advantage of the first good weather, and the work pushed. Before lifting the plants from the seed bed, it should be copiously watered so as to soften it in order that they may be taken up without breaking the roots.

The same general directions given in the chapter on root crops for setting out sweet potato plants will apply to tobacco. If there are several hands at work, it is best to appoint a foreman who will oversee the job. The plants should be set well down in the soil, and the earth pressed so firmly that if you

take a leaf between the thumb and finger and give a jerk, a piece will break out. If you pull the plant up instead, it shows that it is not well planted, and would be almost sure to die if dry weather follows. As soon as possible replace missing plants so as to have a perfect stand.

The first enemy that will give you trouble is the cut-worm, and the remedy generally recommended is to go over and kill the worms by hand and reset. Some claim that ashes or a spoonful of salt and plaster scattered round the plants will save them, but whatever is done must be done promptly. The cultivation must be thorough. It seems useless to give detailed directions, but it will certainly pay to keep a crop clean and growing, that costs in labor and manure as much as a tobacco crop does. Continue the cultivation till the plants spread, so that you can not work them without breaking the leaves.

WORMING.—By the time the leaves are as large as a man's hand, you must begin to look for the green worms. They usually stay on the lower side of the leaf, and if you see a hole in a leaf, no matter how small, turn it up and you will be pretty sure to find the worm. This work must be done thoroughly, for if you miss one or two worms, before you know it the plant will be nearly eaten up. It will usually be necessary to go over the field and kill the worms twice a week from about the middle of July till cutting begins. While killing the worms, keep a lookout for the eggs, and also destroy as many of the moths as possible. The latter are about half as large as a humming-bird, and can be seen about sundown flying from plant to plant. The worms, although repulsive in appearance, are perfectly harmless and are usually killed with thumb and finger by a pinch and twist.

PRIMING.—What is called priming, is the breaking off of the bottom leaves which grow so near the ground as to lie flat, and rot or get dirty, and this work should be done as early as the plant will admit of it. The distance from the ground that the leaves should be removed varies with different varieties from four to six inches. Some growers omit it and sort out the lower leaves after the crop is cut, and sell them for about half price. Those who do not prime, generally top lower than those who do. In taking

off these leaves, care must be taken not to injure the plant; for if torn downward, the plant would often be wounded so that it would take more strength to heal it than to perfect the leaves.

TOPPING.—This is done to prevent blossoming and to throw the strength to the leaves which would otherwise go to make seed. This must be done as soon as the seed-buds show, and often earlier, and sometimes it is necessary to take off one or more leaves. In determining when to top and how much to take off, good judgment is required. The planter should ask first, "Is there time enough to ripen the upper leaves fully?" and, second, "Is there strength enough in the plant and soil to mature all the leaves?" If he can answer "yes," to both questions, only the flower-stalk need be removed; but if "no," he tops to from eight to sixteen leaves, according to his judgment. Here will be seen the importance of starting the plants early, as the yield may often be increased one-half by it.

SUCKERING.—This is for the same purpose as the topping—to concentrate the strength of the plant in the leaf. The suckers start where the stem of the leaf joins the stalk. They draw off the nutriment, and do not grow to be of any value, and so, must be removed. This is one of the most tedious operations in tobacco culture, for the suckers do not all appear at once, coming first on the lower leaves, later on the middle, and last at the top, and sometimes will even start a second time where they were first removed. None of these operations—priming, topping, or suckering—should be done when the plant is wet, either with rain or dew; for, if handled when wet, rust-spots will appear on the leaves, which will increase in size till they destroy them.

HARVESTING.—Tobacco, as it ripens, changes color, assuming a piebald or spotted appearance, and the leaves feel sticky, and when bent, break off short. These appearances indicate that it is ready to cut. The dry-house should be in order, and sticks provided. The plants are cut close to the ground and allowed to wilt, so as to toughen them, when they are taken to the dry-house. All the handling must be done with the utmost care, so as not to bruise or break the leaves. Some growers practice splitting

the stem from the top down to within six inches of the ground before cutting, claiming that the tobacco cures better. When thus split the plants are hung astride the sticks; when not split the plants are sometimes nailed to the sticks and sometimes hung with strings. A tobacco barn, to hold two and a half acres, should be twenty-four feet square, and with posts high enough to give five tiers, the lowest six feet from the ground. Some practice fire-curing, which is done by building fires in holes dug in the ground under the tobacco, and allowing the heat and smoke to pass up through it; and this is necessary when the buildings are crowded, especially in damp weather. Others prefer to build larger barns, and give the plants more room, thus avoiding the expense and risk of fire, as there is always danger of burning the building.

STRIPPING.—When the tobacco is thoroughly cured, so that the stem of the leaf shows no sap, it is ready to strip. This must be done in damp weather. The leaves are stripped from the stems and assorted into their grades. Ten to fifteen leaves are put in a bunch and tied together at the butts, and this makes what is called a “hand of tobacco.”

From the foregoing it will be evident to the farmer who has no practical knowledge of the crop, that it would be folly for him to attempt to grow it on a large scale with only such knowledge as can be obtained from books. There are nice points in the curing and handling of tobacco which can only be learned by experience and familiarity with the plant. It is a crop like cotton, which gives work almost the entire year, and which admits of no delay or postponement, and no one should attempt to grow it unless willing to work early and late, and so situated as to command all the help necessary. When we consider the risk of the crop, the large amount of labor and manure required to grow it, its exhaustion of the soil, and that it only gratifies a depraved taste, and is largely used by poor men whose families need every dollar they can earn, it becomes a question to which careful consideration should be given before any farmer undertakes its production. If any one determines to engage in the business, he should either begin with a very small plot, and in-

crease as he gains the necessary knowledge, or he should hire some one experienced in its management to take charge of it.

PROPERTIES.—An analysis of the ash of tobacco shows the following per cent of the various constituents:

Potash,	12.14
Soda,	0.07
Lime,	45.90
Magnesia,	13.09
Chloride of Sodium,	3.49
Chloride of Potassium,	3.98
Phosphate of Iron,	5.48
Phosphate of Lime,	1.49
Sulphate of Lime,	6.35
Silica,	8.01
<hr/>	
Total,	100.00

From the above table can be seen what mineral matters predominate in the plant.

CHAPTER X.

ROOT CROPS.

IN this chapter I shall include potatoes, sweet potatoes, and onions, as well as roots for stock feeding.

Potatoes.—The product of potatoes in the United States for eleven years, from 1871 to 1881 inclusive, was as follows :

Years.	Acres.	Bushels.	Average price per bushel.	Average yield per acre.	Average value per acre.
1871	1,220,912	120,416,100	\$0 60	99	\$58 83
1872	1,331,331	113,516,000	60	85	51 14
1873	1,295,139	106,089,000	70	82	57 47
1874	1,310,041	105,981,000	68	81	54 83
1875	1,510,041	166,877,000	39	111	43 06
1876	1,741,983	124,827,000	67	72	48 14
1877	1,792,287	170,092,000	45	95	42 54
1878	1,776,000	124,126,650	59	70	41 14
1879	1,836,800	181,626,400	44	99	43 09
1880	1,842,510	167,659,570	48	91	44 00
1881	2,041,670	109,145,494	91	53	48 63
Annual average.	1,608,974	135,491,019	59	87	47 68

I think we can study the figures given in the above tables with profit, and there are several points to which I wish to call attention. First, you will notice that the smallest acreage gave the largest profit per acre. The four years in which there were less than one and a half million acres planted, are the only ones in which the average value per acre exceeds fifty dollars.

Again, you will notice, that the years of greatest yield per acre were not always the most profitable, as you will observe by comparing 1875 with a yield of 111 bushels, and 1879 with a yield of 99 bushels, with the years 1876 and 1881, when the

yield was 72 and 53 bushels respectively. The first two years the value per acre was a fraction over \$43, and the last two it was over \$48, making a difference of \$5 per acre in favor of the smaller yields, and as the average is 105 bushels per acre for the two largest yields, and but 62½ for the two smallest, it will be seen that the farmer received five dollars more per acre for the labor of handling the small crop than he did for the large. You will also notice the high average value per acre of the crop, \$47.68. During this same period, the average value of the corn crop was \$11.20, and of the wheat crop \$12.82 per acre, so it will be seen that the potatoes brought nearly four times as much per acre as the wheat, and more than four times as much as corn.

I think these figures teach plainly that the farmer who will prepare and cultivate his land properly, and follow growing potatoes every year, will find the crop a very profitable one, and if he is thorough in his work, so as to grow average crops in the bad seasons, he will realize his greatest profit in the years which give nearest a failure of the crop. In proof of this, I would mention the case of a farmer who, in 1881, grew a heavy crop of potatoes. You will see from our table that the yield per acre that year was very much lower than any other season during the eleven years, and the average price higher. Following his usual plan of thorough work, this man averaged \$160 per acre from his crop of early potatoes, and \$100 per acre for the late crop and realized over two thousand dollars for his entire crop. I have been acquainted with a few farmers who have made potatoes a leading crop, and they have in every instance made a handsome profit.

PREPARATION OF THE SOIL.—I think no crop grown on the farm pays better than potatoes, for extra work before planting. The period of growth is short, especially with the early varieties, and it is necessary to have the land in such condition that the plant food is available, and the plant will push at once into a vigorous growth. To do this our land must be well drained, for we can not work a heavy, wet soil. I prefer fall plowing for this crop, and find that a sod turned under gives the

best mechanical condition. I would advise that the manure be applied in the fall immediately after breaking, as early planting gives the best results, and it is usually difficult to wagon over the plowed ground as early as you want to plant in the spring. As soon as the land is in a condition to be worked well in the spring, go to work mellowing the surface. Do not attempt to plow it again, no matter how much it has been packed and settled, but with the best implements at your command work down from the top. The disk harrows are advisable for this purpose, but you can work it fine and deep with the cultivator with bull tongues and a heavy, common harrow if you will take time. As you pulverize it you will mix the manure thoroughly, and when you have six inches of mellow, fine soil, you are ready to plant.

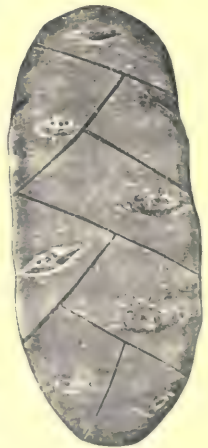
PLANTING.—I prefer to lay off my potato land with a shovel plow with a long narrow point, as it makes a deep furrow with plenty of loose soil in the bottom. I believe in close planting, so as to fully occupy the land and enable the crop to shade the soil thoroughly, and think for most varieties, rows three feet apart, and hills eighteen inches in the row, will give the best results. This will give 9,680 hills to the acre; and an average of one pound to the hill will make a yield of over one hundred and sixty bushels per acre. I think it a great advantage to step on the seed in planting, so as to press it well down in the furrow and bring it in close contact with the soil. The advantages are that it is less likely to be displaced in covering, and less earth will be required to cover it to a sufficient depth, it will be less likely to be frozen when the planting is done early, or to be dried out when late, and it will start quicker when pressed closely in contact with the soil, than if lying in loose earth.

The amount of seed to be used is a matter of considerable importance, and one on which farmers should experiment carefully. Page 229 shows the result of an experiment made by J. L. Delano, of Massachusetts. Eight plots of twenty square rods each were planted with hills three feet by eighteen inches apart, and seed prepared as described. Medium sized potatoes

were selected and were first cut so as to divide the seed end from the stem end. The table will be readily understood.

Number of plot...	KIND OF SEED.	Weight of seed in pounds	Weight of crop in pounds	Crop in bushels...	Weight of large potatoes.....	Bushels of large potatoes.....	Weight of small potatoes.....	Bushels of small potatoes.....
STEM-END.								
1	One eye.....	18	960	16	912	15 $\frac{1}{4}$	48	3 $\frac{3}{4}$
2	Two eyes.....	30	1,500	25	1,408	23 $\frac{1}{2}$	92	1 $\frac{1}{2}$
3	Four eyes.....	46	1,815	30 $\frac{1}{4}$	1,652	27 $\frac{1}{2}$	163	2 $\frac{3}{4}$
4	Half of potato.....	60	1,440	24	1,234	20 $\frac{1}{2}$	206	3 $\frac{1}{2}$
SEED-END.								
5	One eye.....	19	1,050	17 $\frac{1}{2}$	1,015	17	36	1 $\frac{1}{2}$
6	Two eyes.....	24	1,560	26	1,470	24 $\frac{1}{2}$	90	1 $\frac{1}{2}$
7	Four eyes.....	47	1,905	31 $\frac{3}{4}$	1,745	29	160	2 $\frac{3}{4}$
8	Half of Potato.....	61	1,560	26	1,320	22	240	4

It will pay to carefully study this table. You will see that there is little difference in the value of the seed-end and the stem-end of the potato and that neither one or two eyes are sufficient unless the hills are planted too close for easy cultivation. The best result in both cases was from four eyes and a much larger proportion of small potatoes resulted from the half potato. The amount of seed per acre varies from a little less than two and a half to over eight bushels per acre. I think there is no question as to the economy and propriety of cutting seed, and my judgment is that the best results will follow cutting to two eyes. If four eyes are wanted in the hill put in two pieces. There is also a right and wrong way to cut seed, the right way being to cut so as to have the piece run to the center of the potato. I prefer to begin at the stem-end, as the eyes are farther apart there, and cut angling across the potato so that



HOW TO CUT SEED.

each piece shall be triangular, with the point running to the middle of the potato. The cut gives an idea of how the work should be done.

From the illustration one might suppose there was but one eye to a piece, but the second eye is on the opposite side. Experiments made on Houghton farm showed a marked difference in the product from shallow cut eyes, or those cut as shown in the engraving. The results of three experiments were as follows :

	Shallow eyes.	Deep eyes.
No. 1, twenty hills, produced, . . .	2 lbs. 6 oz.	6 lbs. 11 oz.
“ 2, “ “ “ . . .	2 “ 6 “	5 “ 15 “
“ 3, “ “ “ . . .	3 “ 13 “	15 “ 13 “

If you have a new and high-priced variety of seed, and wish to make all you can from it, then cut to single eyes, as you will see from the table that one eye produced more than half as many potatoes as four eyes and with a smaller per cent of unmerchantable ones. When a potato is planted whole a portion of the eyes remain dormant, but there will still enough grow to make the plants too much crowded in the hill and so produce an undue proportion of small tubers. This is shown in our table. The small potatoes from the seed cut to one eye were but 4.18 per cent of the crop, and from the seed cut to two eyes but 5.95 per cent, while from half potatoes 14.87 per cent were small.

It sometimes becomes a question of considerable importance whether very small seed will produce a profitable crop, as a short crop often makes the price of seed very high. I do not advocate the use of small seed ordinarily, but by careful experiment I am fully satisfied that it may be used occasionally with good results. I give here the results of several experiments :

I raised a large crop of extra nice potatoes in the summer of 1857, and did not sell till the following spring. When I was taking them out of the pit I concluded to try an experiment, and so I selected enough seed to plant five rows, ten rods long, of the finest potatoes that could be picked out from one hun-

dred bushels. I did not take a potato that would weigh less than a pound, or one that had a blemish or rough place on it, and I never saw a handsomer bushel of potatoes than those selected. I then selected enough seed for five rows of the poorest potatoes I could find. I did not select one but what was less than an ounce in weight, and when I could break off a knob from a big rough potato I did so. It did not take over a half peck of seed to plant as much land as the bushel of large ones planted. These were planted side by side, cultivated just alike, and dug the same day.

I put the product of each five rows in a pile by themselves, and called a carpenter and his three assistants, who were at work for me, to come and examine them, telling of the two kinds of seed from which they were grown, but did not tell them which pile grew from the large seed. The three young men said they could see no difference in quantity or quality, but the boss carpenter, after a careful examination, picked out the pile grown from the small seed as having the largest proportion of merchantable potatoes.

In the fall of 1859 the potato crop was quite short. Mine did not make over thirty bushels to the acre, as I see by reference to my diary. I assorted them into three sizes, putting the very small ones by themselves, intending to cook them for the pigs; but, when I was planting the next spring, I ran out of seed, and so went to the barrel of very small potatoes to finish. I planted nearly a half acre of this very small seed, and never grew a finer crop, quality and quantity considered. Several years later I planted a row of potatoes from seed so small that it took ten of them to weigh an ounce, and had just as good potatoes, both in yield and quality, as from the adjoining rows, planted with selected seed.

When this question was discussed in our farmers' club, Mr. J. B. Pugh stated that, when he was living in Warren County, O., there was nearly a failure of the potato crop, and seed was worth two dollars per bushel. He traded a sack of oats for a bushel of very small potatoes, which a neighbor was about to feed to his hogs, thinking they would not do to plant. He cut

them, and said the pieces were not much larger than grains of corn, and a bushel planted an acre. The result was a very fine crop, both in yield and quality.

I think that, with medium-sized seed, properly cut, five bushels is sufficient for an acre. It is of greater importance to have the seed sound than that it be large. I have rarely seen a good crop of potatoes grown from shriveled, sprouted seed, and, as seed is much less likely to sprout in pits than in the cellar, I prefer to pit my seed. The best time to select seed is at digging time, as there is less difficulty in detecting any admixture at this time than in the spring. Smooth, good-shaped tubers that will average the size of a hen's egg I believe to be as good as larger ones, and if these are taken out it leaves those which are to be sold or used looking all the better.

I recommend early planting for most varieties, and think that, in a great majority of cases, it will give the best yield. There are some varieties, like the Peach-blow, that will grow all through the hot weather, and make the crop in a short time after the fall rains come, which may be planted in June, and will make a profitable yield.

I believe, also, in deep planting, and this is the reason why I recommend laying off the land with the long-pointed shovel plow, and stepping on the seed. When planted in this way they can be covered with the plow, harrow, or cultivator. If the land is loose I prefer the harrow, but if it has been compacted it is better to use an implement that will stir it somewhat.

COVERING WITH STRAW.—Some very excellent crops of potatoes have been grown by covering with straw, while in other cases it has resulted in failure. I think that, under favorable conditions, it is an excellent way to plant, as no cultivation will be necessary, and the straw, decaying, will enrich the land. This plan will not succeed on a cold, wet soil unless the season proves a dry one, and I would not advise that it be tried, except on a soil either naturally or artificially drained. When the potatoes are to be covered with straw I would lay off shallow, and cover lightly, and not apply the straw till the potatoes began to show above the ground. The straw should be thick enough to keep

down all weeds. When ready to dig, the straw can be put up in cocks, like hay, and a good portion of it can be used a second year. One of the most successful potato growers I ever met was using all his straw for this purpose, planting an average of five acres each year in this way.

VARIETIES.—If I should give a list of varieties that had given satisfaction here in my own locality, it would not be the best for a majority of our readers, and as I believe that this is a question which every farmer must settle for himself, I shall not attempt to make out such a list. You will find lists and descriptions in the catalogues of all our leading seedsmen from which to make your selections, and my advice is that you experiment with one or more new varieties each year. I have increased the yield and profits of the potato crop largely by changing varieties, and think that nearly every farmer can do the same. I would advise, in trying any new variety, that but a few be bought; a peck is enough, and often a single pound will be better. A bushel is often grown from a pound, and I have known this yield doubled, and thus in two years a pound will enable you to test a variety thoroughly, and leave seed for one or more acres. In deciding what varieties to plant you must take into consideration table quality, yield, and salability. If you grow only for your own use, a variety that is first-class for the table, even though it will not yield quite so well, will be most desirable. For example, I plant early Ohio and Snow-flake for my own use, but Burbank, mammoth Pearl, or Peerless for market. The Burbank I have found especially profitable, as it yields largely, and with a very small per cent of unsalable tubers, and for some years has commanded the highest price in the market; and yet, on my soil, it does not equal in quality the first two named varieties.

CULTIVATION.—Constant and thorough culture will always be found profitable with this crop. The season of growth is short, and we ought to do all we can to push them. Like corn, I think cultivation should begin before they are up, and from that time till the vines fall the land should be kept clean and loose. In some seasons this will require double the number of workings

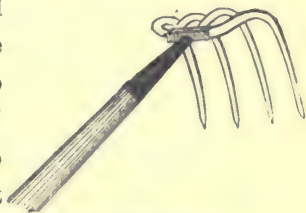
that will be needed in others, so no rule can be laid down as to the number of times they should be plowed. I like the bar-plow in the potatoes when they are small, as it turns the earth away from them, and in working it back we get it thoroughly pulverized. At the later plowings we make up a broad, flat hill. After the vines fall and horse cultivation ends, if weeds start we take them out with hoes, for I do not like to dig potatoes among the weeds. There is a popular notion that it will not do to disturb the vines after they blossom, and that weeds do not injure the crop at this stage, but I believe both are wrong, for I am sure that, with moderate care, the vines will not be injured, and I know that often the crop is cut short from one-fourth to one-half, and the labor of digging greatly increased, by the weeds, and, in addition, the land filled with seed.

The Colorado beetle has ceased to be a terror to the potato grower, and I have found the best remedy to be a thrifty plant. I have not used Paris green or hand-picking for ten years, except in 1880, when a severe drought checked the growth of the vines so that the beetles were getting the start of them. When I do use Paris green, I prefer to use it in water rather than to dust in on the vines. I use a whisk-broom to sprinkle them, and find about two pounds to the acre is sufficient. I recommend, however, that instead of using Paris green, you try cultivating twice a week, and attach to the end of the singletree a light brush, so arranged that it will brush the young beetles off ahead of the cultivator. Probably many of them will crawl back onto the vines, but some of the smaller ones will be killed, and the extra workings will give the plants extra vigor. If the bugs were bad, I would work still oftener.

HARVESTING, STORING, AND MARKETING.—Notwithstanding there are many styles of potato diggers on the market, I have never seen one that I should be willing to use; or, at least, that I would recommend to the farmer who only grows an acre or so of potatoes. The trouble with most of them is that they leave more potatoes in the ground than will pay for digging by hand, unless the price is low. With clean land and a good yield, the

cost of hand digging will not exceed three cents a bushel, as a hand can dig forty bushels or more a day, and the potatoes will be left in more convenient shape for picking up and sorting than if dug by a horse machine.

I have never found an implement for hand digging that was so satisfactory as the potato hook. The form is shown in the cut. It should be of the best steel, and strong enough both in prongs and handle so that you can strike a hard blow to settle it into the ground without fear of breaking it, and without causing it to spring. I can dig with this implement with much less weariness or strain of muscle than with the fork-spade. In digging with it, you strike it into the ground just beyond the hill, so as to clear the potatoes, and then lifting the handle gives a leverage which lifts the potatoes and loosens the hill. Then a dragging stroke or two rakes out the potatoes.



POTATO HOOK.

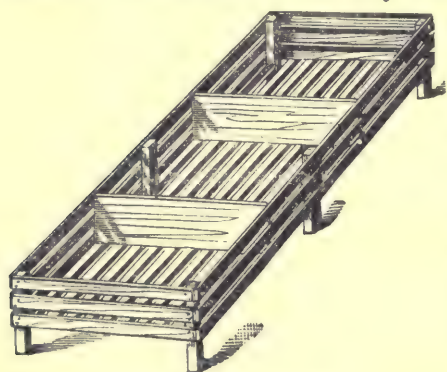
I prefer always to sort the potatoes as I pick them up. First, take such as are fine, for market—don't try to smuggle in a few small ones, or those which have had a fork-tine through them; you will be certain to lose more than you will make by it. Put only good-sized, smooth tubers in the lot which is designed for market or home use. From those left, select for your seed smooth, good-shaped tubers, about the size of a hen's egg. Let the remainder go for stock food. Much time will be saved by doing the sorting as you pick up the potatoes. It takes but little longer to pick them up in this way than to pick all up together, and sorting after gathering is a tedious job.

I think considerable time and stooping is saved by throwing the small potatoes in piles as you pick up the large ones, as this will save going over all the ground again. You can throw six or eight feet ahead and back, and the contents of three rows on the middle one, so as to leave all the small potatoes from half a square rod in a pile.

The best way to handle potatoes is in common grain sacks, with only a bushel in a sack. I think this filling the sacks only

half full an important matter, as it makes them light to handle and does away with the necessity of tying, and two men can load or unload a wagon in twenty minutes. If you pour the potatoes loose in the wagon-box, you must have a team to keep the wagon alongside of where you are digging, or else must carry the potatoes some distance to reach the wagon, while if you put them into sacks you can drop a sack wherever filled and then, when a load is ready, drive around and pick them up.

If you expect to market before spring, you should store in the cellar, and it will pay to make some good movable bins for them. These can be of any size you wish, but should always



A MOVABLE POTATO BIN.

be of a size that can be carried in and out of the cellar. The accompanying cut shows one convenient form.

This is made of strips, both for the bottom and sides, with spaces between them, and being raised upon legs, thorough ventilation is secured. Cross-boards may be put in to separate varieties.

If there is a large quantity of potatoes to be stored, several of these bins may be placed one above another, the upper ones being without legs.

The potatoes you wish to keep for a spring market, or for seed, will do better properly buried than kept in a cellar, as they will lose nothing in weight and will not begin to sprout or wilt so early. In pitting potatoes, do not put too large a bulk together. Build them up in a sharp ridge, so as to have a hundred bushels extend about twenty feet, and always run the ridges with the slope of the land, and in starting your pit, begin on the highest land and work down the slope. This will enable you to protect your pit from water, if a sudden rain comes up. I plow out two furrows each way, and throw out the loose earth so as to have the rick of potatoes about four feet wide at the ground, and then slope the sides so that it will be about

three feet high when ready for the earth. It is the usual practice to put a coat of straw next the potatoes, but I prefer to put six or eight inches of mellow earth first, and then the straw. I think this the better plan, because the straw becomes damp, and if the frost reaches it, it is likely to penetrate it, and if there is a layer of dry, mellow earth inside of this, there will be little danger. If you are pitting a hundred bushels or more, it will pay to have a team and plow to loosen the earth and turn it towards the pit. It is not so hard a job as many imagine to bury roots, and I think that I can put enough earth to protect them on a given amount of potatoes with much less labor than I can carry them in and out of the cellar.

Do not take any risks and hope for a mild winter, but be sure and have them protected against any possible temperature. After freezing weather comes give an outside covering to the pits. This may be of coarse manure, straw, or corn fodder. On farms where there is plenty of fodder, the cheapest way to protect the pit is to build a rick of fodder over it, as it will be but little injured and can be fed out the latter part of March or first of April.

When the potatoes are to be pitted it is customary to dig and put in small piles, from fifty to one hundred hills to a pile, till all are dug, or at least a sufficient quantity for a fair-sized pit. The usual plan is to throw a few vines over these small piles, and each year large losses are sustained from leaving them in this way. A piece of work prevents the farmer from getting back to the potatoes as soon as he intended, and an unexpected freeze catches them, a heavy rain soaks them through, or the sun turns them green from their being insufficiently covered. I recommend that whenever potatoes are to be left in the field more than twenty-four hours that they always be covered with a few inches of earth first and then with the vines. Less than five minutes' work will be sufficient to put six inches of earth over a pile of five bushels, and then they are safe until the time they ought to be pitted. It is not safe to put potatoes away in bulk when hot from the sun shining on them; and when potatoes are dug early, when the weather is hot and the sun shining

brightly, never leave them long in the sun. I lost one hundred bushels one year by allowing them to lie till the middle of the afternoon, so that when we picked them up they felt hot to the hand.

It is often a difficult question with the grower of early potatoes to know when to dig an early crop. Perhaps the first of August finds them ripe and the vines dead, and if left in the ground and heavy rains follow, they are in danger of either rotting or taking a second growth. If picked up as soon as dug, and put in bins ventilated like that shown in the cut, I find there is no risk in putting potatoes in the cellar in August, providing they are ripe.

Perhaps there is no crop which it is so difficult to tell when to sell to the best advantage as potatoes. There is often a rush which gluts the market at digging time and reduces the price very low, and if held till spring there is some risk, labor, and shrinkage, and but a short time to sell in before the new crop from the South comes in competition with them. When a price can be had which will give a fair profit, I would advise that the bulk of the crop be sold in the fall. I think all things considered fifty cents a bushel when dug is nearly or quite as profitable as seventy cents in May following.

One other point deserving of attention in connection with potatoes is their value for stock. I think that most farmers undervalue them for this purpose, and I am aware that the tables show them to have a large per cent of water and a low albuminoid ratio. I find, however, when fed in connection with other food that they make it more palatable, and I think more easily digested, and a peck of potatoes boiled and mashed, mixed with three pecks of bran and meal makes a palatable food for hogs, and one on which they thrive wonderfully, and I am sure that fed in this way they possess great value; they are also good for milch cows when fed raw.

Sweet Potatoes.—I have found sweet potatoes a profitable market crop, and although writers generally recommend sandy land for them, I have been entirely successful with them on clay upland. It will pay every sweet potato grower to

raise his own plants. They will usually cost him much less than to buy them, often less than one-fourth as much; but even if they cost more I should advise that they be home-grown. My reasons are that by growing your own plants you can always have them when you want them fresh from the bed, and can take advantage of the best weather for setting them out, either on a showery day or late in the evening.

In the years that I have not grown my own plants it has often happened that there would be such a rush that the supply at the beds would be exhausted, and I was unable to get any until so late that I could not grow a good crop. I would not give half price for plants that had been pulled so long that they were wilted. In almost any neighborhood a limited amount of plants can be sold, and it will be found profitable to supply your neighbors.

I have sprouted sweet potatoes for nearly thirty years, and for the first ten I oftener made a failure than a success, but do not now remember that I have failed in the last fifteen years, and I think if the directions I give are followed, that even a novice can succeed.

The first point of importance is the selection of seed. It should be sound and fresh, with no signs of decay. Sweet potatoes will not keep long after they are taken from the bins where they are kept for the winter, and if decay has begun it is nearly impossible to get them to sprout well. The bed for sprouting we make perfectly flat; for a frame we nail boards a foot wide together; a convenient size is six feet by sixteen, which will give room for planting about one barrel of medium-sized potatoes. You should nail one or two strips across your frame to stay it and prevent spreading. Have the manure hot when put in the bed, and to insure this you will need to fork up and thoroughly mix it four or five days before you wish to use it. When thoroughly hot prepare the bed for your frame by shaking the hot manure so that there shall be no lumps in it, and building it in a compact heap two feet wider and longer than your frame. It should be perfectly uniform, so that it will all heat alike, and should be packed as solid as it can

be by tramping on strips of board laid on the manure. To tramp it with the feet would pack it too much and unevenly, but by taking strips of board a foot wide and of such length that they can be used the narrow way of the bed, and placing one before the other you can soon press the manure solid and have it uniform throughout. The bed should be prepared about one month before the plants will be needed and this time will vary, of course, in different latitudes. Here in Southern Ohio we start our beds about the middle of April, as we find the middle of May as early as it is profitable to set out the plants, and from that till the middle of June is seasonable.

You do not need so great a depth of manure for a sweet potato bed as for an early hot-bed, which must endure greater changes of temperature; and if the manure is hot and in good condition, one foot after it is packed is sufficient. Then lift your frame on to the manure and bank up around the outside of it with the same kind of manure to the top of the frame; and it is a good plan, both to protect it from cold winds and for the sake of cleanliness, to cover this outside manure with boards. Cheap waste lumber, cut in short pieces and leaned up endwise, is as good as any. If your hot-beds are in a small yard with a tight board fence around it, this protection is not absolutely necessary, but will be found neat and convenient. I like this plan of making the manure bed two feet larger each way than the frame much better than making a deep frame and putting the manure into it, for the latter plan takes much more lumber, and the outer part of the bed is almost sure to be cold, while with this extra width of bed and banking up it is easy to have it uniform in temperature throughout.

After the frame is set on the bed we shake in enough manure to make four inches more after it is packed by tramping on the boards as before. We then fill the frame nearly full of good mellow earth.

The best soil for this purpose is well rotted leaf mold from the woods, and it should be not less than seven inches deep. When complete cover the bed with straw to the depth of eight or ten inches, and to enable you to handle the straw

conveniently have it bound in bundles. Above the straw place a roof of light boards with slope enough to carry off the water. The lower end of the boards can rest on the frame, and the upper end should be raised eighteen inches.

Examine the bed daily, and when you find the earth heating up from the bottom, uncover it in the middle of the day and let the sun on it, and when all the soil is warmed so as to feel comfortable to the hand, it is ready for the potatoes. Begin at one end, and take off three inches of the soil on a strip a foot or two in width, and put it on a wheel-barrow, to be used for covering the last strip at the other end. Now place your potatoes so they will not touch each other on this strip from which the earth has been removed, press them firmly into the soil, and then remove the top three inches of earth from a similar strip, and cover the potatoes already in the bed with this soil. Proceed in this way across the bed. The last strip will be covered with the soil in the wheel-barrow, which was taken from the bed when you began. If the bed is not moist, water moderately, and at once replace the straw and boards. Examine the bed carefully every day by thrusting the hand into it, and if it is warm it will not need uncovering until the plants begin to come up. With the depth of manure I recommend and four inches of good earth under the potatoes, there will be little danger of the bed getting too warm. If it lacks heat, uncover it in the middle of the day, and let the sun shine on it from nine o'clock till three. As soon as you find the plants coming through, uncover the bed and water thoroughly every other day. Do not cover at all again unless there is danger of frost. The more you can expose the plants to harden them the better, and I think it best to withhold water as they get nearly large enough to draw, as the plants will, if watered too frequently, get spindled and tender. The bed should be copiously watered a few hours before the plants are to be drawn.

If the directions here given are followed it is hardly possible to fail of success in sprouting sweet potatoes. My failures in my early experience came from several causes, among which were putting the potatoes too near the manure, with but an

inch and a half of earth between it and them; using rotten wood instead of suitable earth in the bed on the manure; allowing the sun to shine all day on the bed, so that the heat became so great as to scald the potatoes; neglecting to cover the bed properly, and allowing it to be wet through and chilled by cold rains; keeping the seed too long after it was taken from winter quarters before putting it in the bed. Any one of these causes is sufficient to cause a failure in sprouting sweet potatoes.

VARIETIES.—I have found no sweet potato that gives as good satisfaction as the Jersey yellow. The skin and flesh are a deep yellow, and the tubers are smooth, and have the peculiarity of growing short and thick. I am inclined to think this variety identical with the Nansemond, which is a potato of similar color and flavor, but generally longer and more slender. The difference in form is probably due to soil and methods of culture. Sweet potatoes are largely affected by soil and climate, and the same variety that is dry and sweet in one locality is often watery and flavorless in another.

The yam family are generally earlier and grow larger, single specimens often attaining a size of from three to seven pounds; but in the north, at least, they are deficient in quality. I have found the Red Nansemond of excellent flavor and a fair yielder. The Southern Queen is early, a large yielder, and of good shape, and although not equal in quality to Jersey or Nansemond, is worthy of a trial. I can grow as large a yield of sweet as of Irish potatoes, and as the price is usually considerably greater, I always found them a more profitable crop. With a fair season, one hundred bushels to the acre I consider a fair average crop, and one hundred and sixty bushels is not uncommon, while crops have been reported exceeding three hundred bushels to the acre.

PREPARING THE SOIL, PLANTING, AND CULTIVATION.—I have learned by long experience, and have been glad to have it confirmed by many of the most successful sweet potato growers I have met, that shallow plowing and small ridges or hills are best for this crop. If the soil needs manure, give a light dressing that is well rotted before plowing, and then break not

more than four inches deep. I prefer to plow two or three weeks before ridging, as on most soils the land will work finer after having been settled by rains.

When the plants are ready to set, take advantage of the first day when the land is in just the right condition, after a rain, to work it fine with the cultivator and plank drag, pulverizing it thoroughly. Then throw up in ridges with the small one-horse plow. The ridges should be three feet apart from center to center, and thrown up so as to be sharp, not flat, on top. A narrow ridge of earth will be left between the rows, which will be needed for dressing up the hills as they are cultivated. Most growers plant on these ridges, setting the plants about fifteen inches apart; but I find on my soil that it pays to make hills. The extra expense will be small, as two hands will hill an acre a day if the soil is mellow, as it ought to be. The advantages of small hills over ridges are that they warm through more readily and do not become packed so hard, and when the potatoes begin to grow in the hill, they crack and loosen it, and grow larger than they would do in a ridge. The advantage of shallow plowing is that the potatoes soon reach the hard earth, and are checked in their downward growth, and are made short and thick.

We make the rows three feet apart and the hills thirty inches, and this gives 5,808 hills to the acre, and a pound of potatoes to the hill, makes a yield of a fraction over one hundred and sixteen bushels to the acre. Mr. Samuel Silvers, of Butler County, Ohio, has made sweet potatoes his leading crop for many years, and has followed the plan of shallow plowing, so as to have hard earth under small ridges, and he has been remarkably successful. I have a record of his crop for seven years, and find that the yield per acre increased largely as he learned how to manage the crop. His first crop averaged one hundred and twenty-five bushels per acre, and the last of the seven consecutive crops two hundred and sixty-two bushels, and the average for the entire period is one hundred and ninety-eight bushels per acre. Mr. Silvers grew during these years eight or ten acres annually. Whether hills or ridges are made, they should

be left sharp and high, so that when you come to set the plants, you can brush off three or four inches of the top and set them in fresh earth. Do not water, but instead puddle the roots before planting. For this purpose use a mixture of equal parts fresh cow dung and fine mold, stirred till of such a consistency that when the roots are dipped in it they will be thickly coated. This is much better than watering, as the plants are fertilized and a good start given them by the mixture, and if set out on a cloudy day or toward night, they will not wilt at all.

Great care must be taken in setting out, to have the earth well firmed about the roots, and then there should be loose earth drawn up to the plant. There are millions of plants lost every year from neglecting to press the soil to the roots. To determine whether the plants are being set firmly enough, try a plant now and then by taking the leaf between the thumb and finger, and giving a quick jerk. If the plant is properly set, a piece of the leaf will break off; but if the plant pulls up by the root, you may know the ground is not being sufficiently firmed. No vegetable bears transplanting better than the sweet potato, and if the plants are set as fast as taken from the bed and managed as above recommended, there will ordinarily be a very small percentage of loss.

Let the cultivation begin early and be thorough. Hoeing will be necessary, and a narrow cultivator should be run between the rows to loosen a little earth to be drawn up to the plants. I think it an advantage to throw the vines over so as to leave every other space bare. This allows the sun to warm the row better, and saves trouble when you dig.

The potatoes can be plowed out; but I prefer to dig with the potato hook, and by taking a little pains, all the vines can be buried, if they have been kept between alternate rows. The potatoes grow in a clump, and a single stroke with the potato hook will usually dig a hill. I do not think sweet potatoes a wholesome article of diet until they are fully matured; but then I consider them as healthy as the common potato, and far more nutritious.

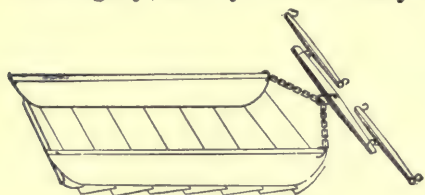
With proper care, sweet potatoes can be kept for several months in an ordinary cellar. To do this, handle carefully, so as not to bruise them, and *they must be thoroughly dried before putting away*. They may be dried on a kiln; but for family use I dry for three days in bright sunshine, taking pains to cover them at night from the dew, and find that when thus dried and put in barrels with dry sawdust, they will keep till nearly spring. I think sweet potatoes might be cultivated farther north than is usually done, as they do not require a long season. I have had them mature a good crop when planted as late as July 1st, and if in the higher latitudes the plants were transplanted to small pots the middle of May, and a month later put in small hills on a dry, warm soil, I believe there would be no trouble in securing a crop.

Onion Growing.—I do not think it necessary in this chapter to treat of button onions, potato onions, or any of the varieties propagated from sets or bulbs; but as the majority of farmers are not familiar with growing onions from seed, and as not only the best, but also cheapest onions are grown in this way, I will give directions for growing the crop.

The soil for onions must be well drained, rich, and clean. Fabulous sums have been realized from onion crops, and every year many of our farmers who know nothing of onion growing, go into the business only to come to grief. I remember one year, when onion seed was worth five dollars per pound, four young men from an adjoining county rented six or eight acres of common corn land, and sent one of their number to me to buy onion seed to plant it. I made some inquiries about the land, and found that they had no manure and no experience, and told them that they would far better throw their money in the fire, and I had hard work to persuade them to go home without the seed.

One fourth acre is the most I would advise any one to plant the first year, and a good deal less than that unless he has land both clean and rich. Onions, unlike most crops, do well on the same land year after year, and if clean land is selected to start with, and no weeds allowed to ripen seed, the labor of cultiva-

ting the crop can be greatly reduced. I recommend fall plowing for onions, unless the land is sandy. I would plow in narrow beds, back-furrowing, so that the center would be the highest. Then top dress with good, fine manure, so as to cover the ground pretty well; from twelve to twenty loads to the acre will not be too much. As soon as the land can be worked nicely in the spring, go to work and mellow three inches of the surface thoroughly, and you are ready to sow. The drag shown in the



A GARDEN DRAG.

cut will be a great help in preparing the land, and by its use hand raking can be entirely dispensed with. For one horse, four feet square is a good size.

It is best to make it of light material, and then, when you wish more weight, you can load it or ride on it.

Good seed is of the greatest importance, and it should be bought only of men of established reputation. If a large amount is to be sown, a seed drill is indispensable. I prefer that the rows be fourteen inches apart, and it is very important that they be made straight. Stretch a line at the side of the bed, and with a marker you can lay off four rows at a time.

In using this marker you walk backward and keep the first runner at the line; in coming back you run the first runner in the last mark, and if at any time you find the rows are getting crooked, it will be best to stretch the line again and start anew. The seed should not be covered deep, and it is wise to attend to the sowing yourself, unless you have a perfectly trusty hand. The drill covers as it drops, and can be run so as to cover from a fourth inch to two or three inches. For early sown onions, the lighter the covering the better. I would advise that where only a small plot is sown, and the sowing is early, the seed be sown on the surface and covered with sifted manure, as this will give the plants a thrifty start.

Some care and calculation will be necessary to know that you are sowing the right quantity of seed per acre. I would recommend that an ounce be weighed out and put in the drill,

and a calculation made from the amount of land it covers as to how much you are using to the acre. At the rate of four pounds per acre, an ounce should cover two and a half square rods, and the drill should drop from ten to fifteen seeds to a foot of row. This will seem like thick seeding to the uninitiated, but I have often counted twelve or more perfect onions to a foot of drill.

I have never found a drill that possessed so many good points as the Mathews, not only for onions but for general work. We use it for any seed from a pea to portulacca or petunia. All the tools described for onions can be used for other garden crops. The best varieties for general cultivation are the red Wethersfield and yellow Danvers, as they are large yielders and good keepers. For home use, some of the white onions are said to be of better flavor. Let the cultivation begin as soon as the plants can be seen in the row, and now you will find the advantage of straight rows, for it will enable you to cut close with the scuffle hoe and have a narrower strip for hand weeding.

The best implement for the first weeding is the scuffle hoe. It is very easy to use, as it does not require you to stoop or bear down as with a common hoe, but the force is applied by pushing it from you. Another advantage is that you walk backwards and do not tramp the land after it is worked, but the weeds are left loose and are more likely to die than if you walk over the land after it is hoed. In a few days after the scuffle hoeing the crop will need weeding by hand, and this should be thoroughly done. There is no other way but to get down on your knees, and with a common table-knife take the weeds from the row. Onions do not need deep culture, but they must be kept clean, and the scuffle hoeings and hand weedings must be repeated often enough to keep down all weeds. After the onions are six inches high the hand plow can be used between the rows, and this will enable you to do the work more rapidly.



SCUFFLE HOE.

HARVESTING.—When the tops have fallen, and the larger part of them are dry, the crop is ready to pull, and three or four rows should be thrown together. If there are any weeds, be sure and destroy them at this time. At the end of a week stir carefully with a wooden rake, taking pains not to bruise them, and repeat as often as necessary; and when dried so as to feel hard they are ready for market or storing, and they may be taken to the barn and spread two feet deep, but the doors should be left open in pleasant weather. The sorting and topping can be done as they are wanted for market.

I would advise selling in the fall whenever a fair price can be had, as there is both labor and risk in wintering. The best way to winter is to spread them on the floor of an outbuilding to the depth of eighteen inches, and leave them till frozen hard. Then cover, to the depth of two feet, with hay or straw. If you have long straw in bundles nothing else will be necessary; but if loose straw or hay is used, it will be best to cover first with sheets, so as to keep the chaff or broken straw from mixing with them. The onions should not be put against the wall, but a space of eighteen inches left, and packed with hay or straw.

Under favorable circumstances the crop is enormously profitable. I have seen six hundred bushels grown to the acre when the price was two and a half dollars a bushel, but such yield and price are exceptional. At one dollar per bushel, and a yield of two hundred bushels per acre, the crop will be found a profitable one.

In closing I will sum up the requisites for successful onion growing, which are: First, clean, rich land; second, plenty of good, fine manure, with no foul seeds in it; third, thorough preparation of the soil; fourth, good seed, properly sown; fifth, clean culture. The gardener who begins with a small area, and increases as he gains experience, will be likely to make a success of onion growing.

Turnips.—The turnip can be so easily grown, on account of its quick maturity, and so cheaply, because it can be grown as a second crop, and generally with no cultivation, that it de-

serves a more prominent place in our agriculture than it has yet attained. In my experience as a market gardener no one crop ever gave me so large a profit, cost considered, as this in occasional years. I have grown from one to five hundred bushels to the acre, and often they have cost less than five cents a bushel when pitted for winter.

Of the flat turnips there are many varieties, but in all the Western markets the "Purple top strap-leaf" sells best, and this is the variety generally cultivated. We sow in Southern Ohio from the middle of July to the first of September, but consider the first ten days of August the best if the weather is favorable. The soil need not be very rich, but they do best where a little manure has been used for a spring crop. I usually grow my heaviest crops among my melons and cucumbers, as these crops are generally planted on manured land, and the shade of the vines is favorable to getting a stand, and the turnip crop will make after the frosts have killed the vines. I have grown profitable crops by plowing a clover-stubble after cutting the first growth for hay, and also by burning off wheat stubble and harrowing the surface till fine and mellow. I have never succeeded with turnips sown on freshly plowed land, but find they do best on land that has become settled, and the surface made fine. Where stubble is to be prepared for turnips, plow as early as possible, and shallow; then harrow and roll at once. When a heavy rain falls, so as to settle it, harrow again, and drag with the plank-drag. If any manure is used it should be applied after plowing, so as to be well mixed with the surface soil by the harrow and drag. One pound of good seed is sufficient for an acre. I prefer not to mix with any thing to sow it, but find that, by using only the thumb and one finger, I can sow evenly, and about the right quantity.

The most important direction I can give for sowing is, *always sow after a rain*. The common practice is to watch, and when a rain is coming sow the seed, so that the rain will wash it in. It is the worst possible plan, as the rain forms a crust and starts a crop of weeds, which often outgrow the turnips and smother them. The turnip fly is also much more liable to

destroy the plants if their growth is checked by a hard crust. When sown as soon after a rain as the land can be nicely worked, the plants come up in two or three days, and start at once into vigorous growth. You can not have the land too smooth or fine to sow on, and after sowing you should run over it with a light plank-drag. If you are putting in a large field it will pay to hitch a horse at each end of a plank sixteen feet long, and make a quick job of it. Turnips may be pitted with less labor than potatoes, as they are not injured by a little freezing, and do not require as much earth. I do not use straw in pitting them, but throw the earth directly on the turnips.

PROFITS OF THE CROP.—Those near a city market, so that the crop can be transported in wagons, will find them more profitable, as they can watch the market and take advantage of a scarcity. I have sold by the wagon load at sixty cents a bushel, and by the car load at thirty-three, the buyer paying freight. If I could contract all I could grow at twenty cents a bushel I should put out large fields each year. I think it as easy to grow two hundred bushels of turnips to the acre as forty of corn, and, as stated, I have grown five hundred bushels. If there is no demand for them, they can be fed to the stock. I have found them of great advantage in fattening old cows, the turnips keeping the system in such a condition that they could eat and digest more grain, and thus be able to lay on flesh rapidly.

Beets and Mangold Wurzels.—Perhaps no other plant will give so great a bulk of food to the acre as beets. From forty to sixty tons of roots have often been grown, and there is one crop on record of over eighty tons to the acre. We have of the mangolds the long and the round, or globe shaped, and the red and yellow in color, while the sugar-beets are white. Analysis shows that size is usually gained at the expense of quality, and that roots weighing eight to nine pounds each contained but about three per cent of sugar, while roots of from one to two pounds each contained over ten per cent.

Beets require a rich, deep soil, and for this crop deep plowing is best. Early planting is advisable, and in this latitude the

earlier in April the better, if the land is in good order. Plant level, as they can be cultivated easier thus than on ridges. Make the rows two feet apart. Set the drill so as to drop four to six seeds to the foot, as it is easy to thin the crop, and a good stand is desirable. By planting in rows, this distance apart, most of the cultivation can be done with a horse after the plants are six inches high. Attend to the thinning as soon as the plants are large enough so that you can get hold of them with the thumb and finger. Every day's delay in thinning will reduce the yield of the crop. Leave the plants from eight to twelve inches apart in the row. It is not nearly so much work to cultivate a beet crop as onions, for they grow rapidly, and in a few weeks shade the ground so completely as to keep down all weeds.

The crop should be gathered before the weather is cold enough to freeze them, for if frosted they will not keep. The tops should be removed either by twisting them off or by cutting, care being taken not to cut the beets, as it will cause them to rot. They may be stored either in the cellar or in pits; in the latter case they must be as well protected as potatoes. Mangolds undergo a ripening process after they are gathered, which makes them more healthful and nutritious, a part of the starch being converted into sugar; and it is, therefore, best that they should be kept till the latter part of the winter. In feeding roots of any kind, begin with a moderate quantity, and increase gradually. When only a limited quantity are grown they may be cut with a spade, but where grown largely a good root cutting machine will pay. The dairyman or farmer who is feeding cattle for beef in winter who gives beets a fair trial will be likely to continue their cultivation.

Carrots.—This root is greatly esteemed for feed both for horses and milch cows. A few fed daily to a horse or other grain-fed animal aids the digestion and makes the hair glossy, and the color of the milk and butter is greatly improved by feeding the cows on carrots.

Every thing that has been said about selecting clean soil, giving thorough preparation, and clean culture to other root

crops, applies with equal force to carrots. The plants come up small and weak, and prompt and vigorous work will be necessary to save them from the weeds. It is best to sow rather early, as the seed will not bear deep covering, and if planting is postponed till the sun is hot and the ground dry, it is difficult to get a stand. Sow in rows fifteen inches apart, and thin to three or four inches in the row. One and a half to two pounds of good seed per acre is all that will be needed. The Short Horn is recommended by Mr. Gregory, and the particular strain known as the Danvers as the best. It is of a rich dark orange color, smooth, and handsome, and much easier to dig than the long Orange. On good soil, with thorough culture, from twenty to forty tons per acre are grown, or from four to eight hundred bushels.

The same implements and general cultivation that is recommended for onions will suit for carrots, except that while the cultivation of onions should always be shallow, deep culture is beneficial to the carrot. I use a long, narrow bull-tongue, which will work six inches or more in depth, and find no difficulty in driving a gentle horse in a fifteen-inch row. The growing of roots of all the varieties mentioned calls for high farming. The land must not only be rich and clean, but help must be plenty, and the work done at the right time and well done. With these conditions fulfilled, these crops will prove profitable; but without them, vexation and loss will result.

Artichokes.—I have one very important direction to give on the subject of planting artichokes, and it is embodied in one word—*Don't*. I planted two bushels four years ago, and have cropped the land ever since, growing corn, wheat, and vines on it, and have failed to kill them out. I did not find them profitable or palatable for stock, and would as soon recommend the planting of *Canada Thistles*.

CHAPTER XI.

FRUIT ON THE FARM.

WHILE but few farmers should undertake fruit-growing as a business, with a view to making money out of it, there is no farmer, whether his land is rich or poor, or the area small or great, but should plant fruit for the family; and, notwithstanding occasional failures and the many enemies the fruit-grower must contend with, there is no other way in which, at the same cost, so much of luxury can be provided for the family.

Fruits are also healthful, and those who eat freely and regularly of fresh, ripe fruits, are usually free from derangements of the stomach and bowels. This is not true of fruits bought in market, which are often stale and unwholesome; but on the farm, where they can be had fresh, children may be allowed to eat all they want through the season, and will be benefited rather than injured thereby. A moderate amount of land devoted to fruit, if managed intelligently, will furnish a constant succession from the time strawberries ripen till freezing weather, and a sufficiency to can for winter use, and it should be the aim of every farmer to provide fruits for this succession.

The first requisite in fruit-growing is common sense, and to see how fruit-growing is managed on many farms one might think this a scarce commodity. The farmer who will thoroughly prepare his land and cultivate grain crops, will plant out a few peach and cherry trees in the fence corners, and pay no further attention to them, and will grow a crop of grain in the apple orchard each year, and from these neglected trees expect a supply of fruit for the family.

To successfully grow fruit of any kind requires intelligence in

the selection of location for the orchard or garden and of varieties, and thorough cultivation of the soil and attention to the wants of the trees, and without these failure is assured as certainly as it would be if a crop of corn was badly put in and then left without further care. There is no mystery about fruit-growing, and no valid reason why every farmer should not succeed at least with some varieties, while many who are favorably located as to soil, markets, etc., could embark in the business of growing fruit for market with a certainty of profit.

Selection of Orchard Site.—Wherever it is possible, the orchard should be located on rolling land having good surface drainage. Even hillsides that are too steep for profitable cultivation will make good orchard lands, and clay land is preferable to that which is rich in vegetable matter.

Our best grain lands, black loam or alluvial, are not to be chosen for orchards, as they tend to produce too great a growth of wood, and to keep it growing late in the fall, so that the new growth is not well matured, and the buds consequently not well developed. Such lands usually lie low, and are more subject to frost in early spring than the higher rolling lands.

The farmer can not always have a good location for an orchard, but he should understand what is likely to prove successful, and not attempt to engage in fruit growing as a business on a farm well suited to grain, and on which fruit growing is almost certain to prove unprofitable. Fruit trees will not be thrifty and will be likely to winter-kill on lands that are saturated with water in winter and spring, and on such land drainage must be provided.

I have seen such good results from a very simple and inexpensive method of surface drainage that I am prepared to recommend it. My attention was first called to this plan in 1860, in the flat lands of Allen County, Indiana. My father was buying and shipping apples from that part of the State, and he found some orchards that were wonderfully prolific, and with fruit of the highest excellence on flat wet lands, that were so flooded with water as to endanger the life of trees planted in the usual manner. In these orchards the ground was plowed in

narrow lands, back furrowing where the row of trees was to be planted and ridging the earth as much as possible. The trees were then placed on the top of the plowed land, the roots spread out and earth brought from the dead furrows to cover the roots and raise a mound around each tree, so as to hold it firm. Every time the orchard was plowed or cultivated, the earth was worked towards the trees and the dead furrows kept open, and by the time the trees were in bearing they stood on a ridge more than three feet above the bottom of the dead furrows, and with more than double depth of the best soil under the roots.

In 1868 I planted one hundred Early May cherry trees on this plan on a piece of cold, wet, clay land. As these trees were but one rod apart we could shovel the soil from the dead furrows directly around the roots, which made it easy to get earth to cover them. At the lower side of the orchard there was not fall enough to remove the water, and one row of trees was drowned out entirely; but as far as I kept the furrows clear and the trees on the ridges, they made a most excellent growth, and the orchard has proved the most uniformly profitable of any that I ever planted. I mention these instances to show that natural difficulties may often be overcome by the exercise of judgment.

Selection of Trees.—What I have to say under this head applies with equal force to all varieties of fruit. Never buy a fruit tree of an irresponsible agent who is a stranger to you. There is no business that offers so easy an opportunity for swindling as that of selling fruit trees, from the fact that it is impossible to detect the imposture till the orchard comes into bearing, and this gives the dishonest agent an opportunity to cheat the buyer with perfect safety.

Refuse stock has been bought by the car load from the large commercial nurseries and sold under false names and at high prices to the farmers of the West. A nursery man often overestimates the demand for a particular variety of apple or some other fruit, and finds himself over-stocked, and is glad to sell out for a cent or two a tree, as he would otherwise be

obliged to dig and burn them. These trees are bought by unprincipled scoundrels, and labeled to suit the wants of customers. Then armed with a book of colored plates and an oiled tongue, the purchaser starts out to gull the farmers. Often the agents employed to canvass are honest and ignorant of the fraud, but that does not help the farmer. It seems strange that so many intelligent farmers who are shrewd enough in all ordinary business transactions should allow themselves to be swindled by tree agents.

Go to the nursery and select your own trees. I presume there are few farmers but can find a good reliable nursery within from twenty to fifty miles, and it were better to be at the expense of a journey for ten dollars' worth of trees than to find after years of care and waiting that you have some worthless variety. Often several neighbors can unite and send one of their number to the nursery, and thus reduce the expense.

Plant Young Trees.—I give this advice after more than twenty-five years' experience in tree-planting, during which time I have set and fruited more than one thousand trees. Peach, pear, cherry, plum, and quince, I would always set in the orchard at one year old, and apples at two. I can give a number of valid reasons for this advice.

1st. The trees will cost less at the nursery, and can be packed and transported cheaper, and it will be less work to plant them.

2d. They will be surer to grow, as they will be less disturbed by transplanting, and will have better roots in proportion to their tops than if older.

3d. They will become established sooner and adapted to the soil in which they are to grow if transplanted young, and can be more easily brought to the shape the owner desires.

4th. In a few years from setting they will be as large, and will come into bearing as soon or sooner than the larger and more expensive trees.

In planting the cherry orchard before referred to I tested the relative value of large and small trees. One row was set with large trees six feet high, which were retailing at forty cents each, and the remainder of the orchard from a lot of

small trees, averaging about two feet high, which I bought for six cents each. I cut the small trees back to within a foot or less of the ground, and in four years they had fully caught up with the large ones, and came into bearing just as soon.

So thoroughly convinced am I of the superiority of young trees, that I would plant them if they cost fifty per cent more than larger ones, instead of considerably less.

Selection of Varieties.—Many mistakes are made under this head, and the more common one is to plant too many kinds. It is a matter, too, in which the advice given in books is of little value, for each soil and locality has its varieties which are suited to it, and often a variety that will give good satisfaction in one locality may be nearly worthless fifty miles away. Every one intending to plant an orchard should take pains for some months beforehand to inquire among his neighbors as to what kinds have been most prolific and regular bearers, and have sold best in the market, and given the best satisfaction in the family. This matter becomes one of special importance in commercial fruit growing; and in planting for this purpose a few leading varieties will usually give a large profit, while an orchard planted with a large number will often prove unprofitable.

To illustrate this, I planted in 1860 an orchard containing one hundred apple and three hundred peach trees. I had little experience in fruit growing, and thought it best to plant a great number of varieties and so planted nearly thirty varieties of apple and fifteen of peach. The result was that fully three-fourths of the orchard never paid for planting, while the remaining fourth gave a very large profit. Nearly all the money made from apples came from three varieties, Baldwin and Smith-cider, for winter fruit, and Maiden Blush for summer, of which the orchard contained about twenty trees. If the entire orchard had been of these varieties the profit would have been increased from \$500 to \$1,000. Three varieties of peach, Crawford's Early, Honest John, and Cooledge's Favorite, of which there were seventy-five trees, gave more profit than all the rest of the orchard.

It will not do to be governed by the advice of some one in

a different locality, for climate and soil may totally change the character of a fruit. The Northern Spy is a good illustration of this. In Michigan, Northern Ohio, and New York, I find it an excellent keeper, and one of the very best winter apples, while on our limestone soil in South-western Ohio, it is a fall apple, and comes in at a season when the market is glutted and prices at the lowest. A little thought will show how important it is for the farmer who expects to make money by fruit growing, to not only have a general knowledge of the business, but also to understand thoroughly the peculiarities of his own locality. He must also understand how to market, as it is not always the best fruit that will give the greatest profit. A red apple of inferior quality will out sell a much better one that has a dull color, and an apple of the greatest excellence, is often a shy or irregular bearer. A fruit well adapted to canning is always in demand, but one unsuited to this purpose will find comparatively few customers. For example, when the "Wild Goose Plum" was first introduced, I bought some of the fruit and had it cooked, and found that though it was of very pleasant flavor raw, it was sour and acrid when cooked. I wrote an article for the agricultural press cautioning fruit growers against planting it largely, and giving my reasons. The article was replied to by a prominent nurseryman in the Miami Valley, who took issue with me, and greatly praised the fruit as one that would give great and sure profit. Six years later I noticed in a report of a meeting of horticulturists, this same nurseryman conceded the very points I had made, and advised against planting it. Two orchards of this fruit set out in my neighborhood were cut down within ten years without giving a dollar profit. Under each kind of fruit I shall give a list of general excellence, but wish it distinctly understood that judgment must be used by the individual.

Planting an Orchard.—With young, healthy trees, of good varieties selected, you are ready to plant, and to this work be sure and give your personal supervision. The land should be broken up beforehand, as you can not grow good trees in a wheat or grass field, and it is more difficult to plow the land

well after the trees are set out without injuring them. If surface drainage is needed, as suggested previously, dig a shallow hole, or set the trees on the surface and raise the earth around them. Ordinarily, however, you will need to dig a hole two spits deep, and much labor can be saved by proper management.

For small trees dig the hole two feet in diameter, and lay the surface soil to one side, then go another spit deep and put this subsoil on the opposite side of the hole. This hole will usually be six or eight inches deeper than you will want to set the tree. Now, with the spade cut down the edges of the hole, and fill the bottom with the soil as you widen the hole, and you will have a bed of good, mellow surface soil to set your tree on, and a hole three or three and a half feet wide. Spread out the roots of the tree so they will be in a natural position, and sift down among them well fined earth from the surface soil. Churn the tree up and down slightly to make sure that all the interstices are filled, and when well covered press firmly on all sides with the foot. Finally, put the subsoil on the surface around the tree. If there are any sods place them inverted around the outer edge of the hole, and see that they are covered so that they can not sprout and they will decay and furnish just the plant food the trees need. It will take time and labor to plant a tree well, but the future growth will repay it. An orchard not only presents a better appearance if the rows are straight, but it will be easier to cultivate between the trees. It is easy to set the stakes straight, but after the holes are dug, if the trees vary a few inches from the center of the holes, or the hole is not dug so that the stake was the center, the result is a crooked row. A very simple device, which can be made in a few minutes, will enable you to set the trees exactly where the stake stood. It is shown in the cut. It is simply a piece of board, five or six feet long, with a hole near each end and a notch cut out



A TREE PLANTER.

of the side. When you are ready to dig the hole lay your board down so that the stake will fit in the notch. Then drive a small stake through each of the holes in the board, take up your board and center stake and dig

the hole. When ready to plant the tree, lay your board across the hole so that the two stakes will fit in the end holes, and set your tree in the notch, and it must stand just where the stake did; and if the stakes were set right, the rows must be straight. This board also serves to steady the tree while the earth is being filled in around it.

Pruning.—The top of fruit trees when transplanted should be well cut back, especially if the roots have been at all injured. I have always succeeded in getting a better shaped head when setting young, small trees by cutting off all side branches and heading back a little. If any roots have been bruised or mangled they should be pared smooth with a knife. If pains is taken from the start, but little pruning will be necessary. Much of the pruning can be done with the hand by rubbing out sprouts as they start.

Perhaps less wisdom is shown in tree pruning as usually done than in any other farm operation. The orchard will be neglected for years, and then with ax and saw is cut and slashed so as to nearly ruin it. In pruning a young orchard, one needs to look forward and anticipate the growth, and the intelligent orchardist will be able to give a reason for every cut he makes. Our objects in pruning are, to prevent the branches from becoming crowded, which would cause small fruit and injury from abrasion; to admit sun and air; and to preserve a well-balanced and symmetrical top. By keeping these points in mind, and remembering that there is to be constant growth, one can easily prune correctly.

Cultivation.—Every young orchard should have thorough cultivation for at least three years. It is quite a common practice to set out fruit trees in a wheat field or to sow the young orchard in oats, and I have seen a large orchard planted in a meadow, great care being taken to kill as little grass as possible. A thrifty and profitable orchard can not be grown in this way. The young orchard should always be planted in a crop that will neither shade the trees or deprive them of moisture. Beans, potatoes, sweet potatoes, tomatoes, or vines of any kind can be grown at a positive advantage to the trees. Great care must be taken when using a horse among the trees not to

injure them. Only a gentle horse and a careful man should be allowed to cultivate among them, and a short single-tree should be used, and the end of it well padded. A quince or peach orchard should be cultivated as long as it remains in bearing; but apples, pears, and cherries may have clover sown among them after they have a good, thrifty start of three or four years, and be pastured with hogs.

I think hogs a great benefit to an orchard if they are properly managed, as by eating the fruit which falls prematurely and that which is decaying they destroy the many injurious insects which, if not kept in check, would soon make it impossible for us to grow fruit. Hogs allowed the run of the orchard should be rung, and should be shut out during wet weather, when the land is soft.

I think clover better than grass in the orchard, because it does not form a sod, and the growth is not heavy in dense shade, and if pastured moderately close the orchard will be benefited more by the droppings of the hogs than damaged by the clover. I would not leave the orchard in grass or clover for a series of years, but would cultivate it thoroughly every third year. In plowing up an old orchard, the plow should not run so deep as to tear up many of the roots, but as shallow as can be done to kill out weeds and grass and give a mellow surface. Where plenty of material can be had, it is a good plan to mulch the ground under the trees, so as to kill out all grass and weeds. If this mulching is done with coarse, half-rotted manure, all the better. To manure or mulch a fruit tree properly is not merely to put it around the trunk, but it should extend as far as the drip of the branches. Thorough cultivation and manuring will often work wonders on an old, unthrifty orchard.

In the chapter on Entomology you will find a description of insect enemies, with directions how to combat them.

Apples.—I would plant apples thirty-three feet apart, which gives forty trees to the acre. If peaches are wanted, they may be set between the apple-trees each way, which will make three peach-trees to one of apple, and make the trees just

one rod apart. Two and a half acres will contain just four hundred trees of both kinds. I planted an orchard of this size in this way, and found that the peach-trees were out of the way before the apple-trees needed the room. I give below a list of general excellence for family use:

Early—Early Harvest, Benoni, Red Astrachan. *Fall*—Maiden Blush, Porter, Bellmont, Fall Wine, Fall Pippin, Jersey Sweet. *Winter*—Yellow Bellflower, Baldwin, Smith Cider, Rambo, White Pippin, Wine Sap, Golden Russet, Ben Davis, Rome Beauty, Rawles Janet, Wagoner.

Peaches.—I have never found any trouble in growing a vigorous, healthy peach-tree, although, on account of the tenderness of the fruit-buds, I have often had the crop killed by frost, and sometimes an orchard will bear but a single crop during its life-time. One rod apart each way is a suitable width for planting; but if a large orchard is planted, I would recommend that every fifth space be left wider, so that there would be no difficulty in driving through to gather the fruit.

A small peach-tree will do better than a large one, and I would not plant a tree more than one year old from the bud if I could get it for nothing. Nursery men often sort out the trees under four feet high, and sell them at half price as second class, and I have frequently tested them beside first class trees from five to seven feet high, and in two years the small trees will overtake the large ones. In planting a large orchard, the use of these small trees makes a large saving.

I advise that all side branches be removed at the time of transplanting and the trees headed back. This close pruning will cause a much stronger and more satisfactory growth. After setting, the peach requires but little pruning, and large branches should never be cut. The twigs should be thinned out a little, and the new growth cut back each year. Cultivation will largely increase the size and market value of the fruit.

The following list embraces such as have proved the best in my experience: Troth's Early, Early Amsden, Crawford's Early, Crawford's Late, Smock, Stump the World, Old Mixon, Switzerland, Oxford Late, Heath Cling, Salway.

Pears.—The one great drawback to the cultivation of pears is the blight. Probably the most successful pear grower in the West, if not in the Union, is N. Ohmer, of Dayton, O. He has planted since 1868 over 3,500 pear-trees, and made the growing of pears profitable. He recommends, a deep, well underdrained, rich clay soil, and that no manure be used; that planting be shallow, and the earth worked to the trees, so as to give surface drainage. Cultivate three years, and then seed to clover and allow the second crop to decay on the ground. After this the orchard is not cultivated, but the grass allowed to come in and take possession.

Mr. Ohmer is quite sure that to stimulate the growth of wood by either manure or cultivation increases the danger of blight. In proof of this he cites the following examples: In 1869 he planted an orchard of seven hundred Bartletts, and cultivated it for five years, losing more or less each year, till more than one hundred were dead. He then seeded it to grass, and the blight disappeared in two years. Another orchard, which had not blighted, but had a heavy sod, was plowed up, thinking it would improve the fruit, and the blight appeared, and many of the trees died. He also recommends that the trees be headed low, so that the branches shall shade and protect the trunk. I have referred thus at length to Mr. Ohmer's experience, because his twenty-five years of success in the business give weight to his suggestions. He does not believe that blight can be avoided entirely by following the directions given above, but that its evils may be mitigated.

My own experience in pear culture extends over twenty-five years, during which time I have planted about three hundred trees. I have found the Buffum, Flemish Beauty, Seckel, and Tyson free from blight, but have lost about half the Bartletts; but notwithstanding the blight, I have found pear culture fairly profitable.

The following list is given as embracing the best varieties for family use: Bartlett, Osband's Summer, Sheldon, Tyson, Seckel, Clapp's Favorite, Lawrence, Bloodgood. Mr. Ohmer recommends for an orchard of one thousand trees, 150 Bartlett,

150 Beurre de Anjou, 150 Duchess, 150 Lawrence, 100 Beurre Clairgeau, 50 Howell, 50 Flemish Beauty, 50 Seckel, 100 Rostiezer, 50 Louise Bonne, and 50 Sheldon.

I find that after the blight has prevailed for a series of years, it will often disappear and the trees that remain will be healthy, vigorous bearers for a long period. I think the farmer with a soil suited to pears could scarcely fail to make their growing profitable, for if three-fourths of the trees on an acre died, there would be enough left to give a large profit, as the crop from a single tree will often bring more money than an acre of corn. I would plant sixteen and a half feet apart, as the growth of pear trees is usually upright, and they will bear close planting. My Bartlett orchard is now fourteen years old and is planted this distance apart, and none of the trees interfere with each other, or look as though they would for many years to come.

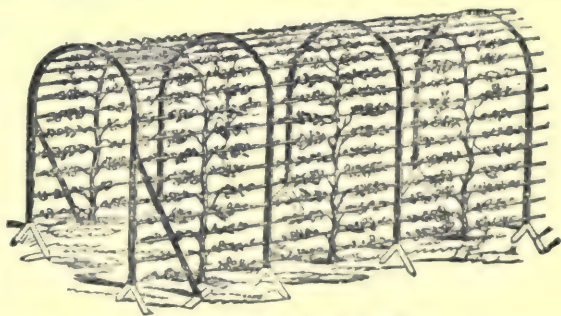
I have always had good success in transplanting pear trees at one year old from the bud or graft, but have found when large trees were moved a considerable per cent of them would die. I think that one-year old trees can be bought at most nurseries for about twenty cents each. One hundred and sixty trees, which would plant an acre, would cost, including the labor of setting, about forty dollars. During the three or four years that the orchard should be cultivated, crops may be grown on the land, which will pay for the labor and a fair interest on the investment, and after that the grass would pay at least a moderate interest, and if forty trees escaped the blight and came into full bearing, enough would be left to give a large profit, as good pears are always in demand at fair prices.

In proof of the statement that enough trees are likely to survive to render pear growing profitable, I give the record of several orchards. My first planting was in 1859, twenty-seven trees. In 1883 there were thirteen alive, ten of them vigorous and full of fruit. In 1869 I planted an orchard of eighty Bartletts, of which there are now standing forty-five. This orchard has suffered severely with blight, but it has been decreasing for a few years, and it now shows very little blight. Another

orchard of sixty trees, twelve years old, all Bartlett, is three-fourths dead, but seems to have now passed the blighting stage. There is one old tree near, which for thirty-five years has borne heavy crops, never missing except when a heavy freeze came late in the season, as in 1875 and 1882. This tree has made so little new wood that it has not increased perceptibly in size during the time I have known it, but all its energies are devoted to the production of fruit. Mr. Ohmer reported twenty years after planting his first orchard of four hundred and twenty trees, that but eighty had died, and if we except three varieties which proved failures, his five orchards of three thousand five hundred trees show about the same per cent of loss.

Dwarf Pears.—Dwarf pears are produced by grafting pear stock on the roots of the Angiers Quince. This produces a small tree which comes early into bearing and produces a very fine quality of fruit. These dwarf trees may be planted eight feet apart each way, which gives 680 trees to the acre. Some varieties do not succeed well on the quince, while others do remarkably well. Mr. Ohmer had great success with *Beurre de Anjou* and *Duchess* as dwarfs, and on my grounds the *Flemish Beauty* and *Seckel* have given good satisfaction. If dwarf pears are set deeply they will often strike root from the pear stock and become vigorous standard trees. Of eighteen dwarfs which I planted in 1859, there are now, in 1884, six large, thrifty trees in full bearing.

Any one who has a taste for horticulture, and the time to devote to it, can produce a pleasing effect by training dwarf pear trees to the sides of a bower, as shown



DWARF PEAR TREE BOWER.

in the cut. A grape-vine might be planted at each end to run over the top of the bower, and the pear trees kept on the sides, as the grape would give a better shade, and is also less liable to rot if allowed to run high above the ground.

Plums.—The great enemy of the plum is the curculio, which stings the fruit when young and tender, and deposits within it an egg. This hatches into a grub, which causes the fruit to fall before maturity. The tree is also subject to a disease called black knot, and to rotting of the fruit and defoliation during July and August. For the curculio, planting the trees in a hog lot, or poultry yard, or where the branches overhang water, or paving under the trees has often proved a remedy, as the instinct of the insect seems to teach it to deposit its eggs only under such circumstances as will insure reproduction.

The most effectual remedy is jarring the trees to cause the insects to fall on a sheet held for the purpose of catching them. The habit of the insects when disturbed of folding their legs and feigning death, makes it easy to capture them thus. For large orchards various devices have been used. A frame like an inverted umbrella, lined with canvas, and with an opening at one side to receive the tree, is placed on a wheelbarrow and trundled from tree to tree. The operator carries a heavy mallet with which he strikes the tree on a spike which has been driven in it for the purpose. In some of these it is arranged that the insects fall into a pan of coal oil, and others are provided with pockets; which retain them till they can be destroyed with hot water. As the period when the curculio damages the fruit is but short, this method will pay for large orchards. The trees should be jarred early in the morning, at which time the insects are sluggish. The work of jarring should begin soon after the fruit forms, and should be repeated every morning for two or three weeks, if rewarded by the capture of sufficient insects to pay.

For the diseases mentioned, there are no specific remedies, but supplying manure and salt to the soil often acts as a cure or preventive, and sprinkling the trees with a solution of one ounce of copperas to two gallons of water is *said* to be a cure. Ashes applied to the soil is also a preventive. Thinning the fruit is found a remedy for rotting, as it is believed to originate from exhaustion of the tree from overbearing. The plum will flourish on a great variety of soils, but should never be planted on wet land, as it needs thorough drainage.

Varieties.—Probably the most profitable of all the plums grown is the “Damson.” It is a small, blue plum, with a bloom of a lighter blue, and is a popular and excellent fruit for canning. The tree is a prolific bearer, and the fruit possesses the valuable quality of remaining fit for market for some weeks, and also bears transportation well. The tree comes into bearing early, and often proves exceedingly profitable. Although writers catalogue a hundred varieties of this fruit, it would be impossible to name a list that would be of general value, and we therefore leave it for each planter to decide for himself.

Quinces.—I have found the quince a more regular and constant bearer than any other of the orchard fruits. Even in the seasons of hard, late frosts which kill the blossoms, the quince will, like the grape, put out a second bloom and make some fruit. I have gathered eleven successive crops—most of them heavy—from the same orchard.

The quince requires a deep soil, and should be kept free from grass and weeds, either by mulching or cultivation. Salt at the rate of a quart to the tree is recommended to be used in connection with stable manure. Quinces are hardy, and may be planted in the fall. They do best transplanted at one year old from cutting. Plant twelve feet apart, which will give three hundred and two trees to the acre, but if a large orchard is planted, leave every fifth space twenty feet wide for drawing in manure and taking out the fruit. The trees require considerable pruning, as the fruit is produced on spurs two or more years old, and shortening the wood induces the formation of fruit buds.

One excellent quality of the quince is that it bears handling and keeps well, and may be shipped to a distant market with safety. The varieties are few, and the Orange is the standard, and the one best suited for the family or market.

Cherries.—A moderate sized cherry orchard, of well selected varieties will furnish a succession of fruit for two months or more. Cherries will grow on most soils if well drained, and as I have proved in the orchard before referred to, they can be grown successfully on wet soils by surface drainage alone. The smaller varieties, such as the Dukes and Morellos, may be set

as close as the peach, but the larger varieties should be twenty to twenty-five feet apart. But little pruning will be needed for any of the varieties, but if it is necessary to remove branches, it is best to do it in July, or when the terminal buds are forming. Like all other varieties of fruit, the cherry should have clean cultivation for a few years until the trees are well established.

The following list comprises the varieties which have proved best in my experience: Early Purple Guigne, Bowman's May, Early Richmond, May Duke, Belle De Choisy, Elton, Black Tartarian, Governor Wood, and Belle Magnifique. Of these, the first two named are the earliest, ripening before or with strawberries. I have not found them profitable for market, but valuable for the family because of their earliness. Belle Magnifique is the latest, and ripens slowly, lasting till the first of August. The fruit of this variety is very large and of especial value for culinary purposes. For rich and delicate flavor, the Belle De Choisy stands unrivaled. I have never tasted its equal. It is only a moderate bearer, but quite regular, and is not suited for marketing. It ripens the last of June. For market, the Early Richmond and Black Tartarian are the varieties which I have found most profitable.

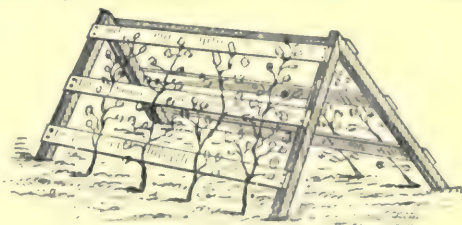
The first named is also called early May, the Pie Cherry, the Canning Cherry, and by other local names. There are probably ten bushels of this cherry sold in Cincinnati market to one of all other varieties, and no other that I am acquainted with gives so great profit. The trees come into bearing young, and give large and regular crops. They may be headed low, so that for many years a large part of the fruit can be gathered by standing on a chair. The fruit grows in pairs, is of a light red, is very prolific, and when fully ripe of a delicious flavor. The orchard before alluded to, is almost wholly of this variety, and has missed giving a full crop but twice in eight years, and then gave an abundance for family use. The cherries from this orchard have been mostly sold at five cents a quart on the tree, the purchaser gathering them. No pains has ever been taken to keep the birds from them, as we prefer to have them tame and never allow one killed, and no account has been kept of

cherries canned or used in the family, and the sales have averaged fifty dollars a year. The trees are not long-lived, but will usually continue in bearing from ten to fifteen years.

The Black Tartarian is a large, sweet cherry, heart-shaped and glossy, of a purplish-black color, and ripens the last of June. The tree is of a peculiar, upright and compact habit of growth, with large, dark foliage, and often attains to great size. It is a very prolific bearer, often producing many bushels of fruit to the tree, which, on account of its size, beauty, and flavor is very salable.

Grapes.—Probably no other fruit grown will furnish a family supply with so little labor and risk of failure as the grape. If one owns a single square yard of land in which to put the roots of a grape-vine, it can be trained to the house side and will for years produce a liberal supply of fruit. There are in my neighborhood thrifty vines in full bearing, that I have known for thirty-five years, and they were old in appearance when I first saw them. I have a single Concord vine which is trained to the south end of a summer kitchen and arbor over the west door, which covers about twenty square yards and has not missed a crop in ten years, and in favorable years I have counted one thousand clusters on it. It has had no cultivation, and aside from gathering the fruit, less than a half hour's work a year in pruning keeps it in order. I would always transplant at one year old. I do not advise close planting and training to stakes, as by training to trellises and wider planting I have seen the best results.

A cheap trellis can be made by setting posts and stretching wires, or cheap bowers can be made of rough poles or some lasting wood like locust. A family supply of fruit can usually be grown by training vines to out-buildings or to rough bowers or trellises where a screen shade or good protection is desirable. Another cheap and servicable trellis is shown in the cut. This is a self-supporting trellis for two rows, and is made by leaning

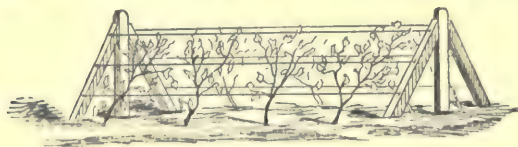


SELF-SUPPORTING GRAPE TRELLIS.

scantling against each other like the rafters of a house. A short board near the top and a strip near the ground should be nailed across to keep them from spreading and to hold them to their place, and the strips nailed to them to support the vines would hold them firmly. When first put up it would be necessary to secure the bottoms to prevent their being blown over in a gale, and this could be done by driving a stake firmly into the ground flat against the side of the uprights of the trellis and driving a spike through it. As the vines grow and cover the trellis, they can be made to hold it down firmly by training some of them under and some over the strips. This trellis should always run north and south so as to give the vines an equal share of sun. I would recommend oak two by four inches and eight feet long for the uprights, set them edge-wise and place the bottoms six feet apart.

I would plant the vines for trellising in this way: in rows eight feet apart where the trellis was to go, and twelve feet between the trellises. This would leave a space between the trellises to drive a wagon to take in manure and get the fruit, and these spaces could be cultivated and made to grow good crops, as the vines running up the leaning trellis would shade much less than if perpendicular. The vines would stand a foot from the bottom of the trellis, which would give room to hoe or spade around them. Light poles of durable wood could be used to spike on to this trellis in place of boards. The land under the trellis would be so shaded that it would be impossible for weeds to grow.

The cost of this trellis will vary in different localities; but as it will answer for two rows, it would not be expensive, and it seems to me to possess advantages over all others. If tender varieties are planted, which need winter protection, a



SELF-SUPPORTING WIRE TRELLIS.

row of corn fodder can be leaned up against them.

Still another way to make a cheap trellis for two rows is to set strong posts, seven feet high and thirty feet apart, and lean

a scantling from each side and secure them to the posts by a carriage bolt, and then stretch wires for the vines to run on. This would be much cheaper than boards, as the posts could be much farther apart, and the wires would be more durable.

The varieties of grapes are almost numberless, and each year brings out new ones, which sell at high prices. These are often exceedingly valuable *to the nurseryman*, but seldom to the buyer. I have at different times bought one or more of these new high-priced varieties—probably ten or twelve in all—and have never been rewarded with a single bunch of grapes from one of them. Those which have given me the best satisfaction are the Concord, Catawba, Ives, Delaware, Clinton, and Hartford Prolific. With the exception of the Catawba and Delaware, these are not first-class grapes; but they bear abundant crops, and when fully ripe are very eatable.

The Catawba in its perfection is delicious; but occasionally it fails to ripen. With me it will mature a crop two years out of three, and if it would only do so every third year, I would still grow it for family use.

The Concord is the grape for the million. It is an early and abundant bearer, has large fruit in large clusters covered with a blue bloom. I have fruited this variety for twelve years without a single failure; but some years the vines so exhaust themselves by overbearing that the crop is inferior both in quality and quantity the ensuing year; yet this can be largely remedied by attention to pruning.

The Delaware, where it will succeed, is an excellent table grape, and will give the best of satisfaction for family use.

The Ives is prolific and hardy, and when fully ripe is good flavored. But as it colors long before it is ripe, it is usually gathered before its fine flavor is developed, and many who have fruited it for years have very little idea of its excellence.

In pruning the grape, bear in mind that the fruit grows on new wood made from buds which start the same spring. In pruning young vines, the object is to get a good, healthy vine. At one year old the vine should be cut back to two buds, and when they start rub out the weaker one. Cut back well each

spring till the vines are old enough to bear, and then train upon the trellis two canes for leaders. After this the pruning will consist in cutting back the laterals to one bud, which will grow the bearing wood for the coming season. The best time to prune is after the leaves fall in autumn; but it may be done any time during the winter when the wood is not frozen. If deferred till the sap starts in the spring, the vines will bleed profusely; and while I have known vines to bear good crops when treated thus, I would advise early pruning so as to avoid it. If possible, place the vineyard on rolling land; but whatever situation you have for them, you will be likely to succeed with the hardy varieties.

Small Fruits.—It is a deplorable fact that berries are rarely found on the tables of the majority of farmers. I think it safe to affirm that not one farmer in five—possibly not one in ten—has ever grown a strawberry, and there seems to be an opinion that peculiar skill and knowledge is required to grow this fruit. It *will* require more labor, but not more skill, to grow a good crop of strawberries than of potatoes. It is necessary in either case to have a good variety, a good soil, and good cultivation.

The varieties of strawberries are so numerous that to merely name them would more than fill a page of our book. But no list can be given that would be a safe guide to the planter, for the variety that does best on one soil or in one location is often unprofitable in another. The only safe rule in choosing is to find out what kinds are giving satisfaction to the growers of your own neighborhood. It is well also to experiment with a few new varieties on your own grounds each year, discarding such as are unprofitable, and extending the cultivation of those which you find suited to your soil and locality. The following list is from standard varieties, some of which have given good success with growers in all parts of the country: Charles Downing, Cumberland Triumph, Sharpless, Duchess, Crescent Seedling, Wilson, Windsor Chief, (Champion), Mount Vernon, (Kirkwood), Bidwell, Captain Jack, Defiance, and Seth Boyden. Among the newer varieties which promise well are Manchester, James Vick, Big Bob, Finch's Prolific, and Indiana. Kentucky and Glendale are desirable late varieties.

SOIL.—Strawberries flourish on a great variety of soils, and no one should be deterred from planting them because his soil is not the best. Any soil that will grow good corn will grow strawberries; but it should be made rich, and should be clean, deep, and mellow. A good loam or loamy clay upland will give the best results. Plow deep in the fall, and manure on the surface with finely rotted barn-yard manure that contains no foul seed, and plant as early in spring as the plants are in good condition for setting. This will be when they have started to grow, but before the fruit buds show. I much prefer spring planting to fall, as it is easier to put a bed in good order and plant it in spring than to get it so if it has been planted in the fall, and a fall planted bed will not give a crop the ensuing spring, and requires more care and labor than if the planting is deferred, as it must be protected two winters before getting a crop.

There is little question that the best results will be obtained by keeping off all runners, as the energies of the plant will then be directed to the development of fruit buds. The advantages of this plan are that the fruit will be finer and more abundant, the bed cultivated with less labor, and can be kept longer in bearing, and nearly all the work of cultivation can be done with a horse; while, if the runners are allowed to set and form a matted row, they must be kept clean by hand. In garden culture, plant rows two feet apart and the plants twelve to fifteen inches; but for field culture, where the hill system is to be followed, I would plant two by two and half feet, so as to cultivate both ways. This would give 8,712 plants to the acre. See that the plant are fresh and vigorous; *the roots should never be allowed to dry*. Our best strawberry growers emphasize this point, and even recommend that the plants should not be dropped ahead of the one who is setting them out, but carried in a vessel with a little water or damp moss. It is also recommended that the roots be shortened one-third of their length, and the tops should always be trimmed of all dead leaves and old runners, so as to leave three green, vigorous leaves. With the close planting recommended it is important that the rows be per-

fectly straight and regular, as it will save much hard work in cultivating them. Remove all blossom buds from the newly set plants as fast as they appear, as the plant will not have vigor enough to produce a crop of fruit and a healthy, vigorous growth at the same time, and as the fruit will at best be inferior in quality, it is better to allow the plant to get all the strength, rather than divert a part of it to the fruit.

I would not advise any one who must buy plants from a distance to set out strawberries largely. It will be better to defer the general planting a year, and grow your own plants.

Be sure you obtain plants true to name from some reliable nurseryman. I think more farmers have made a failure from getting plants of some worthless variety than from any other cause. Because they can get them for the digging, farmers will sometimes go to an old, run-out bed, and dig spindling, weak plants of perhaps several varieties mixed, and because they do not succeed in growing a crop, they conclude there is some mystery about strawberry growing.

The next point necessary to success is winter protection. This is necessary, not to keep the plants from freezing, but from the alternations of freezing and thawing. Whatever material is used should be prepared beforehand, but is better applied after the ground has frozen. When the plants are kept in hills, less material will protect them. Be sure that there is no seed of any kind in your mulch; old, half-rotted straw, the bagasse from the sorgo mill, leaves, second crop hay, or any waste material will answer.

If you want the very best results, work thoroughly in the spring as soon as the soil is in good condition, and then mulch so as to keep the land moist. A very small bed treated in this way will furnish a liberal family supply of the finest fruit. I have known sixty quarts gathered from a square rod, and much larger crops are often grown. E. P. Roe, who is a very successful strawberry grower, recommends this plan of high manuring and cutting off runners, and calls it "Stimulation and Restriction," and claims that we need not fear too much stimulation by manuring and deep and thorough culture, if we prac-

tice the restriction recommended. If the matted row system is followed, it will pay best to plow up the bed after one crop, as it is cheaper to plant a new bed than to clean out an old one, but if the hill system is adopted, three crops may be profitably grown from one planting.

It is wise in strawberry culture to begin with a limited area and increase as you learn what varieties are suited to your soil, and how best to manage and dispose of the crop. If the hill system is followed, it will be necessary to have nursery beds for growing plants; and to make sure of enough, I would advise that one thousand plants be set in the nursery bed for each acre you intend planting the coming year. In a good season this would probably produce four times as many plants as would be needed, but in a dry, unfavorable season, less plants would be produced, and it is better to have a surplus than to fall short. If there is a great abundance of plants, enough can be taken up without disturbing the rows, and a crop be gathered from the nursery beds, and this will enable you to compare the matted row and the hill system. Every successful strawberry grower can sell more or less plants, and often he finds a good income from this source, and it is well to always provide a surplus.

If intending to set out a plantation of strawberries, I would advise that you manage to have the land in clover the preceding year; cut the first crop for hay, and plow down the second growth in July, and seed heavily with buckwheat. When the buckwheat blooms, plow it under and then top dress the bed thoroughly with manure that has been composted, so that you are sure there is no seed in it that will grow. In the spring work the bed till it is perfectly fine and mellow, and then mark it both ways perfectly straight. For this purpose you will need a light sled marker which a man can draw and mark three rows at a time. You will need two sleds of different widths for this purpose, but they can be cheaply and easily made. Stretch the garden line to start with, and walk backwards in marking and you will have no difficulty in keeping the rows straight.

When ready to plant have plenty of help. One man will take up plants as fast as two can trim and prepare them, and

two more set them out, and it will be best to have help enough to do the work in a day if you can. I would recommend that the plants be puddled with a mixture of cow dung and clay, as is described in the chapter on sweet potatoes. I would advise, in growing strawberries on a large scale on this plan of hill culture, that, every four rods, a space of eight feet be left for a wagon-drive, for convenience in drawing in manure and mulch and in taking out the fruit. These strips should be kept cultivated, and after the berry season is over can be planted in some late crop.

As soon as the bed is done bearing, give a thorough working both ways and see that all runners are kept off. Some growers recommend that the plants be closely trimmed of all old leaves and fruit stalks, with a sharp sickle, and I am inclined to favor the plan. Bone meal and ashes are valuable and concentrated fertilizers for the strawberry. The former I would apply at the first working after the bearing season, and the latter in early spring.

I will condense a few points which, if attended to, will insure success in strawberry growing: 1st. A clean soil thoroughly prepared; 2d. A liberal application of well rotted manure; 3d. Strong plants, true to name, set out fresh, with roots always kept moist; 4th. The earth well firmed around the young plants; 5th. Thorough and constant cultivation; 6th. All blossom stalks and runners removed the first spring, as soon as they appear, and all fruit stalks and dead leaves trimmed off as soon as the bearing season is over; 7th. Good winter protection.

Raspberries.—It is doubtful if any other fruit can be produced with so little labor and with so great certainty of an annual crop as the raspberry, if it is intelligently managed. A single planting will last a generation. I have known raspberries to remain in vigorous bearing on the same spot for more than thirty years, and when removed, they seemed to have lost no vigor. As the raspberry renews its canes each year, all that is necessary to keep a plantation healthy, is to give good cultivation, plenty of plant food, and attend to pruning and the removal of the old canes each year, and there seems to be no limit to the

time in which they will remain in bearing. It was the practice formerly to trellis or stake and tie up the canes, which involved the grower in a heavy expense; but our best growers have learned to manage them so that this is not necessary. Mr. Ohmer, on whose fruit farm I have seen eight or ten acres of raspberries in a field, says: "I can and do grow raspberries almost as cheaply as I do corn, not counting the cost of gathering. At one time I advocated and practiced tying up the canes, especially of the black varieties. I have entirely abandoned this, and raise as many bushels per acre and as nice fruit at a much less expense. The additional expense of providing stakes, or posts and wire, is not all I save, as the tying up of the canes took much time, and, of course, cost money."

The way to manage raspberries to avoid trellising, is to pinch back the tops of the canes when two feet high. They then throw out laterals in all directions, which balance and support the main stem. Early the following spring these laterals must be cut back to about one foot in length, and when managed in this way, they will stand up and support the fruit as well as if staked.

Most cultivators of the raspberry make a mistake in planting too close. The rows should not be less than eight feet apart and the plants set three feet in the rows, as this width is necessary for proper cultivation. In planting the Black Caps, or any of the varieties that propagate from the tips, it is usual to advise shallow planting, but when these are not to be staked, they should be set at least three inches deep and then the earth worked to them. Cultivation should be thorough till August, and all surplus plants should be killed out as remorselessly as weeds. The varieties that propagate by suckers will overrun the ground and become a tangled wilderness, and cease bearing unless the suckers are kept down. Three or four canes to a hill will give more and better fruit than a larger number.

Probably the cheapest and most satisfactory way to manage a plantation for home use is to mulch it heavily. Give the land a thorough working in the spring, and then cover it so thickly with straw that no weeds can grow, and you will have large, fine

berries when your neighbor's neglected plot will suffer greatly with drought. If the mulching is forked away from the rows a little, and the land spaded and the mulch returned and a little extra added each spring, the labor of keeping the plot in order will be greatly reduced, the yield largely increased, and the quality of the fruit greatly improved. Either mulching or thorough cultivation must be given, and on most farms material for mulching is so abundant that it would be cheaper than cultivation.

VARIETIES.—The Gregg, Doolittle and Souhegan are probably the best varieties of the Black Caps, and the Hansell, Cuthbert, Turner, and Brandywine of the red.

Blackberries.—The same general directions for cultivation will apply to the blackberry as the raspberry, except that the blackberry should be trellised. The cheapest and best trellis is a single wire three feet above the ground to which the canes are tied. Some years since nearly all the cultivated varieties were attacked with an orange-colored rust which completely destroyed them, and all attempts to renew the plantations were fruitless, as the plants were killed before they came into bearing. Of late years the disease has disappeared, it is to be hoped never to return. Before this disease appeared I could grow a bushel of blackberries, aside from gathering, as cheaply as a bushel of corn. A very few square rods of land will supply a family for nearly a month, and furnish all that is needed for canning. As it is difficult to keep them in a narrow row, I would recommend that blackberries be planted in rows eight feet apart.

The standard varieties are: the Lawton or New Rochelle, Kittatinny, Wilson's Early, Snyder, and Taylor's Prolific. The Snyder is the hardiest, and is recommended for cold climates or localities where other varieties have been killed out by rust.

Currants.—The currant is very hardy and thrives on almost any soil. If neglected and allowed to become crowded with old wood and choked with grass the plant is short-lived; but if well cultivated and pruned annually, removing all wood that shows signs of decay, and thinning out the new shoots, they can be kept thrifty and bearing for many years. One thing which adds greatly to the value of the currant, is the long time it continues

in use, beginning before the fruit is grown and continuing for many weeks. The season for this fruit may be prolonged till September if the bushes are shaded after the middle of May. This can be done by spreading straw mats, or coffee-sacking over them, allowing it to rest on a frame so as to relieve the bush of its weight. On light soils mulching will keep the land cool and prolong the season. A few bushes well cared for will give better results than a much larger number neglected. I would not advise planting nearer than five feet each way. This will give over seventeen hundred plants to the acre, and four quarts to the plant would make over two hundred bushels of fruit. Near a good market the crop often proves largely profitable, sometimes bringing five hundred dollars or more per acre.

Of late years the currant-worm, in many localities, has eaten all the leaves from the plant, ruining the crop and damaging the plantation. It is not difficult to destroy them if taken in time. They may be treated with powdered hellebore, which may be applied in solution, one tablespoonful to a pailful of water, or it may be mixed with sifted ashes at the rate of one pint to one gallon of ashes and one pint of flour of sulphur. This mixture should be applied when the dew is on, so it will adhere to the leaves. It is important that these remedies be used at the first appearance of the worm, and that they be followed up regularly until all are destroyed. The Red Dutch, White Grape, and Cherry are standard varieties.

Gooseberries.—The same general treatment is required for the gooseberry as for the currant. Plant so as to cultivate both ways, five feet apart each way, and keep well pruned. They yield enormously. I have gathered a bushel from six plants of the Houghton. The large English varieties are subject to mildew and are hardly worthy of cultivation in this country, but the Downing, Smith's Improved, and Houghton are seldom affected, and bear heavy crops. They can be very cheaply gathered by using thick gloves to protect the hands. The picker should wear a long apron, and in gathering he kneels and spreads this on the ground under the bush, then with the gloved hands strips off the berries and lets them fall on the apron.

The berries so gathered are afterwards passed through a fanning-mill to blow out the leaves. In this way one man will gather several bushels in a day. A very few plants will furnish a family supply, and where there is a market for them it will prove largely profitable to grow them for sale.

Commercial Fruit Growing.—There are many locations in which growing fruit for market will prove a profitable business to the man that understands it. To be successful in the business, however, requires a combination of qualities rarely found. The successful fruit grower must be industrious, careful, patient, intelligent, and honest. Industrious, because there is much labor connected with the business which can not be trusted to others, but requires the presence and oversight of the owner. Careful, because there are many things, which, if not done promptly, will result in great loss. Patient, because he will have many difficulties to encounter and many losses to meet, and he must not be easily discouraged. Intelligent, because there are points to be settled upon which his profits largely depend in all the operations of planting and caring for the trees, selecting varieties, and disposing of the crop, which can only be determined by wisdom and experience. Honest, because the man who expects to retain his customers and sell his fruit at a profit, must not “top” his barrels and measures, or attempt to smuggle worthless fruit in the middle of his packages.

Thousands attempt the business of fruit growing and fail for the want of some one or more of these qualities. They hear of the success of some one who has a good market and has thoroughly mastered the business, and without an idea of the necessary qualifications they plant an orchard or set a plot of berries, and the only one who makes any money out of it is the nurseryman who furnishes the stock. The fruit grower must be prepared to handle his fruit promptly, and know just what to do with it, for many kinds of fruit will spoil in twenty-four hours after it is gathered. It must be put up for market in an attractive form, and such as the public demand, for there is fashion in the way fruits must be handled as well as in other

things. All boxes, crates, baskets, etc., must be prepared beforehand, and help engaged to handle the fruit, for there must be no delay. Always give good, honest measure, and a uniform quality throughout the package. Thousands of bushels of fruit are sent to market every year that would have brought more money if one-third of it had been fed to the hogs and the remainder sold.

On this point I quote Mr. Ohmer, whose success and long experience give great authority to what he says: "Many invoices of fruit have been sold for less than the freight and commission charges, principally because they were not properly put up. Dealers want you to face the packages with nice fruit, but they do not want all under the facing to be worthless or indifferent, but merchantable fruit all through. The man who will face a package of fruit and fill up with that which is worthless is not an honest man, but a disgrace to the profession. Such a man ought not and does not make fruit growing pay."

One other point I consider of great importance, especially in the growing of small fruits for market, and that is not to attempt it on a large scale until you have gained some experience. Feel your way carefully into the business, and master every detail as you go along. The man who undertakes to start a large fruit plantation without experience is likely to pay high tuition in the school of experience, and too often fail to get a good education at last.

CHAPTER XII.

GARDENING AND TRUCK FARMING.

THE old-fashioned garden—which, unfortunately, is not yet a thing of the past—will be recognized with a slight description. It is usually paled in, and contains from one-eighth to one-fourth acre. There is a wide border around it which can not be plowed, and here dock, wild parsnips, and other weeds struggle for the mastery, and continually encroach upon the cultivated portions. It contains, also, a row of currant bushes, raspberries, blackberries, and a few quince bushes and grape-vines. The little space left for cultivation is planted in the spring, and after maturing a single crop is neglected for the rest of the season, and before the summer is ended it becomes a wilderness of weeds, and produces seed enough to sow a quarter section of land. It is quite a common sight in September to see the farmer in a garden of this description with a scythe and dung fork trying to find his potato patch.

Very often after the garden is plowed in the spring, the entire care of it devolves on the farmer's wife—who is, perhaps, already overburdened—and what of good it affords, is the result of her warfare with the weeds. The garden can be made the pleasantest and most profitable spot on the farm, and will furnish labor suited to the boys not old enough to do regular field work, and to the grandfather whose day of hard field labor has passed. A fourth acre of rich land in garden, kept clean and thoroughly cultivated, and the land constantly occupied with a succession of crops through the season, will produce a very large amount of family supplies, and I think it a safe estimate that what would cost one hundred dollars in the market can be grown on it.

The business of market gardening has a promising outlook in this country. Good, fresh vegetables are wholesome and cheap living, and our cities are increasing in population much faster than the country, and will furnish a market for a large amount of garden products. Young men with a taste for gardening, who will make themselves masters of the business, will find it remunerative. No one should begin the business of market gardening unless he is willing to work, and can devote his entire time to it and give personal supervision to all the details of the work.

To give some idea of how much can be sold from an acre of garden, I quote from Peter Henderson the cost and proceeds per acre for a few leading crops, and he gives this as the average for ten years:

EXPENDITURES FOR ONE ACRE PER YEAR.

Rent,	\$50 00
Labor,	300 00
Horse labor,	35 00
Manure,	100 00
Seeds,	10 00
Wear and tear of tools, etc.,	10 00
Cost of marketing,	100 00
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Total,	\$605 00

RECEIPTS FOR ONE ACRE PER YEAR.

12,000 early cabbages at 5 cents per head,	\$600 00
14,000 lettuce at 1 cent per head,	140 00
30,000 celery at 2 cents per head,	600 00
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Total,	\$1,340 00
Deduct cost,	605 00
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Leaves profit,	\$735 00

All three of the above crops were grown on the land the same year, which will account for the large amount of labor and manure expended.

Selecting and Preparing the Garden Spot.—Whether the garden is to be merely for the family or a market garden, the same general directions will apply. It should be well drained. The soil should be warm and easily worked. It must be rich. It must be kept free from weeds.

If one is going into the business of market gardening, he

should locate on land well suited to the purpose. But on the farm he can often better afford to make the land what it should be than to have his garden at an inconvenient distance from the house. I would advise that where possible the farm garden be at the rear of the house, near the kitchen, so that it can be seen and be convenient, and that it be protected on the north and west by a tight board fence or an evergreen hedge. If the land is a stiff, cold clay, draw sand and black loam on it till you get it in the right condition, or if a leachy sand, give it a coat of clay. If you are starting a new garden, manure heavily and plow under, and then top dress with manure. There is no danger of getting the land too rich; but after it is once well manured, it will not need so much, and a light top dressing each year will answer.

The garden must be thoroughly drained, and, in addition to underdrains, you should always leave it in such shape in the fall as to give good surface drainage, for you can not have an early, mellow garden on land that the water has stood on through the winter. I find fall plowing a great help in getting land in good order for gardening, and the plan which has given the best satisfaction on my farm is to plow in narrow lands, running with the slope of the land, and then open the dead furrows so as to leave them clear and unobstructed for the water. Pains must be taken to provide an outlet for the water, so it will not stand in the furrows and saturate the land. It is surprising how soon land will dry off in the spring and be ready to plant, and how mellow it will be when treated in this way.

The beginner should not be discouraged if he does not succeed in growing large crops the first year, for it takes several years of manuring and thorough culture to get land into the best condition for growing some of our garden crops. By constant, thorough, and clean culture and a dressing of manure each year, the land can be brought to such a condition that there will be little danger of failure of crops. All the manure for the garden should be well composted, so as to kill any foul seeds it may contain, and so that will be in a condition for immediate use. It should always be kept in flat piles, as this will enable

the manure to maintain uniform heat throughout and decompose, so as to be in the best condition for plant food. Except when starting a garden on new land, I find the greatest benefit from using manure at the surface, and thoroughly incorporating it with the soil by repeated harrowing and stirring with the cultivators. Be careful to avoid getting small stones on the garden with the manure. It is often the case that manure from the village is thrown into a graveled alley and mixed with small stones, which would do little or no harm in a grain field, but which dull the hoes and give great trouble in the garden.

If starting a large garden, and manure enough can not be had to put it in good condition, it will pay to devote a part to green crops for manure the first year. A crop of rye sown in the fall can be turned under in May, and followed by buckwheat, which would be ready to turn under early in July. Then a second crop of buckwheat or one of sowed corn can be grown, and plowed down in time to seed again with rye, and this will make the land so mellow and clean that it will grow good crops of many kinds with but little manure.

The vegetable and fruit gardens should be kept separate, for if currants, raspberries, blackberries, etc., are allowed in the garden, they are almost sure to spread until they take up too much space, and too often to be choked with weeds and seed the balance of the garden.

Laying out the Garden.—The old plan of a grass border and narrow beds sowed crosswise, to be cultivated entirely with the hoe, is no longer followed by experienced gardeners. Whether there is a fourth acre to be cultivated for family use, or the market garden of five or ten acres, it should be laid off so that every thing can be planted in long rows, and cultivated by horse power or with the hand plow. We shall never be able to dispense with the hoe or hand work in the garden; but by proper management and keeping the soil free from weed seeds we can greatly reduce the labor.

No weeds should be allowed to go to seed in the garden under any circumstances. It is not so difficult to prevent this as is often supposed. In most gardens which are allowed to

become overrun with weeds it is due to neglect after the crops have matured. The very day that a crop has gone past use, the land should be cleared and cultivated, and if not planted in another crop, should be stirred often enough to keep it clear of weeds. I would not, however, allow any part of the garden to remain idle, for it is as easy to cultivate a crop as the bare land, and one is not so likely to neglect it. I shall speak of succession of crops elsewhere in this chapter.

A garden managed in this way can after a few years be cultivated with much less labor than one where the land is full of foul seed.

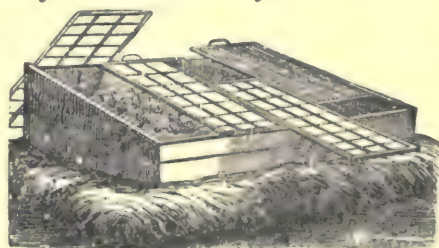
If not experienced in market gardening, it is best to begin with a few crops which are easily managed, and at the same time experiment with others on a small scale, so as to gain experience in their management. The crops best suited for truck farming are tomatoes, sweet corn, sweet potatoes. Irish potatoes, turnips, and cabbages. Lima beans, nutmeg melons, Hubbard squashes, and pickles are also largely profitable when you have a good market for them. Onions require rich land and a good deal of labor, and it will be wise to begin their cultivation on a small scale. But grow some each year, so as to learn their management, and increase if you find them profitable.

Implements.—You will need a good breaking plow, two harrows—one a slicing harrow like the Randall and the other a steel tooth—a roller, drag, marker, cultivator, and seed drill; also garden line and reel, hand plow, hoes, forks, potato hook, spades, watering can, and transplanting trowel. I have never seen a five or seven-tooth cultivator that suited me for garden work. They are too clumsy and hard to manage. I prefer a good “three-shovel,” with the shovels set at just the right slope, and two sets of them—one very narrow to use among small plants, and the other wider, to throw up some earth when the plants are large enough to receive it. For work among small plants it should be provided with a fender, as this will enable you to work very close without covering them. For a seed drill I have never found a better than the Mathews. It is easily

and quickly adjusted to sow seeds of any size from a turnip to a bean, and is very easy to operate.

In a large garden a good hand plow is indispensable. Under certain conditions of soil, one man with one of these will do as much good as six with hoes. On most soils a heavy rain forms a crust and starts a crop of weeds unless the land is stirred as soon as it is in good condition, and with a good hand plow a man can run over an acre in about two hours, and loosen the surface, while to do this with hoes in the same time would require several men. If the surface is only mellowed an inch deep it will kill the weeds that are just starting and prevent the land from crusting and drying out. I have tried several hand-plows, some rigged up with a dozen different tools to be used on the same stock, but I find most of these attachments of little value, and if I were to choose one, it would be a narrow shovel or bull-tongue, not to exceed two inches in width. Next in value to this is a small share, something like that of a breaking plow, so attached that the earth can be turned away from the plants. All the tools used on the hand-plow should be of polished steel, and kept bright, and in using it, run shallow, so that you can walk rapidly with little labor. More can be accomplished in a day by going over the ground twice with it rapidly and easily than once slowly and laboriously.

For starting early plants, a hot-bed will be necessary. It should always be located where it will be protected from the wind, and there should be buildings or a high, tight, board fence to the north and west of it. I prefer one made above



HOT-BED.

ground, as shown in the cut, but if made early, it should be banked up with manure to the top of the frame. The proper slope for the sash can be had by making the rear board a foot wider than the front. The manure should be hot and moist when put in the bed, and should be thoroughly shaken apart, so as to contain no lumps, and be evenly packed. This can be best done by using

small pieces of board, stepping from one to the other and moving them as you cross the bed. For an early bed there should be eighteen inches of manure, when packed, and five or six inches of good soil.

There are three evils to be guarded against in the management of a hot-bed—cold, heat, and over-crowding—which makes the plants weak and spindling. The first can be guarded against by the means already named—a sheltered spot for the beds, and banking up with manure, and in addition, by covering the beds at night with boards, mats, or bundles of straw. To guard against overheating requires constant care; for whenever the sun shines brightly, the bed must be partly opened in the middle of the day, or the plants will be damaged, if not ruined. As the plants grow, they must be thinned, so as to give them room. They may be transplanted into other beds. Enough plants can be started under one sash to fill beds that a dozen will cover, and the plants will be made stocky and much improved by the transplanting. If you have a warm house and a south window, a box may be fitted to the window-sill and held in place by a wire at each end, and enough plants for a family started in it, and these can be transplanted to a hot-bed or cold frame, to give them a start before it is warm enough to put them in the open ground.

A cold frame is the same as a hot-bed without manure. That is, you use the frame and sash, and avail yourself of protection from winds, but depend on the sun for warmth. It will require less watching than the hot-bed, and will give plants several weeks earlier than they can be grown in the open ground. It is of great value also, late in the spring, for protecting tender plants like tomatoes from late frosts, and for this purpose they can be used without glass, as covering will only be required at night.

When to Plant.—No directions can be given when to start a hot-bed, or plant any particular crop, which will suit all parts of a country of such varied climate as ours; but I shall give the time which I have found best in latitude one-half degree north of Cincinnati, and shall try to show how much cold the different

plants will endure, and readers must decide for themselves when to plant in their locality. Every gardener should keep a diary, and record every operation with the date. It becomes exceedingly valuable as the years pass, to be able to look back and see how early and late the different garden crops have been planted, what degree of cold they have endured, and at what date they have matured. All these points are important, and should not be left to memory, but be made a matter of record.

Insects.—In another chapter you will find a description of the various insects which are injurious to the garden, and the best means of preventing their ravages, and I shall only say that to avoid many of them, all that is necessary is a soil so rich and well cultivated as to insure a strong thrifty plant. This is not true of all, and for some, poisons must be used, and when this is done, it should be with extreme care. The remedy should also be applied in time, as a little delay may cause the loss of the plants in spite of all efforts to the contrary. When you have such crops as are liable to the attacks of insects—as young cabbage plants, cucumbers, squashes, melons, etc.,—watch them constantly, and have your poisons already mixed and ready for use. Fortunately, with most of these pests, the period in which they injure the plants is short, and attention for a few days will usually save them.

Rotation and Succession of Crops.—Most garden crops do best if not planted on the same land year after year—onions being perhaps the only exception—and this should be kept in mind in assigning the different vegetables their place in the garden. A garden brought to the condition it should be, is too valuable to grow only one crop in a season, and as there are quick maturing crops, and the planting season lasts from the first of March, or earlier, till September, there is no need of any vacancies. Keep something growing on every foot of the garden, if only sweet corn to grow fodder for the cows. In some cases two crops can stand on the ground at once for a short time, as for example, vines can be planted among the early potatoes and get a little start before the potatoes are dug, or cabbage or sweet corn can be planted in the same way. Beans or cabbage can

follow early lettuce and radishes, cucumbers or sweet corn the early peas, and turnips can be sown among the melon and cucumber vines.

As an example of a succession of crops on the same land in a single year, I one season planted an acre in early peas, and as soon as they were ripe prepared the land and planted it in pickles, and at the last working of the pickles I sowed a pound of turnip-seed. I had very heavy crops of all these, the turnips measuring five hundred bushels. When two or three crops are to be grown on the land there must be no delay in removing one and planting another.

If the land is to be manured again, the manure should be hauled beforehand and heaped at the most convenient point, and there must be help enough to do the work as rapidly as possible. I have often had a crop standing on an acre of land in the morning, and before night it was removed, the land plowed, manured, rolled, harrowed, dragged, and planted in another crop.

The cultivation of the garden can not be too thorough. The late Mr. Root, of Rockford, Illinois, was one of the most successful gardeners and seed growers I ever knew, and his rule was to keep a horse at work all the time, that the land could be stirred on each four acres. Thorough cultivation not only increases the yield, but also improves the quality of the vegetables, for those grown on a rich, well worked soil are more crisp and tender, and of better flavor than such as are of slow, stunted growth.

Planting.—I shall give some hints as to planting and cultivation, with the description of the vegetables, but some general directions for planting seem necessary also.

We have some varieties of vegetables so hardy that they will endure a hard freeze without injury, and these should be planted as soon as the land can be worked in the spring, and if it is plowed and rounded up in narrow lands the preceding fall, as directed elsewhere, it will often be ready to plant two weeks earlier than if left flat to be plowed in the spring. In my latitude we can occasionally plant the last week in February and usually during the first ten days of March. The hardy

vegetables which we plant at this season, are Peas, Beets, Cabbages, Lettuce, Spinach, and Radishes. Mercury may go down to fifteen degrees without damage to any of these, and I have often had them planted when a week or more of severe winter weather would come, with snow and frozen ground, and mercury as low as eight degrees above zero, and no damage whatever befall them. Sometimes, if the ground freezes hard after they are up, the radishes will be killed, but all the others will survive it.

In planting crops which must be cultivated entirely by hand, and especially those which come up small and delicate, like onions, carrots, parsnips, etc., the greatest pains should be taken to get the rows straight. Not only should they be planted by line, but the row should be narrow. If a crooked drill three inches wide is made to receive the seed, which is scattered the full width, there will be three times the amount of hand weeding required than if the seed is deposited in a straight drill less than an inch in width. Judgment must be used also in determining the depth and manner of covering the seed. Most seeds sown late in the season, after the hot weather has come, will need to be covered two or three times as deep as those sown in March or April. Walking on the row to press the soil to the seed has been recommended in many agricultural books and papers of late years, but whether this should be done or not depends on the season, the variety of seed, and kind and condition of soil. On a clay soil, early in the spring, if this was done with some varieties of seed, they would never come up at all, but later in the season it is often necessary to secure a stand.

When it is desirable to press the soil lightly to the seed, the best way is to draw a board over the row, and the pressure can be regulated by weighting the board with earth or stones. In hot weather when there is but little moisture in the soil, this pressing of the earth to the seed will often insure a perfect stand, when without it not half the seed would come up.

If the garden contains so much clay as to be liable to run together and pack after a heavy rain, it will pay to provide sand to cover with. Delicate seeds, such as parsnip, carrot, and

onion, often fail to come up from the fact that they are not strong enough to penetrate the crust, and beans, melons, cucumbers, and the class of plants that come up with a curved stem, also often perish under the weight of water-soaked clay. All these seeds can be sown in shallow drills, and instead of covering them with the clay soil, a little sand used for the purpose. This will not only make a stand surer, but as pure sand usually contains no seeds there will be less labor in weeding the young plants.

There is a best time in which to perform every operation in gardening, and he is most likely to be successful who knows when this time is, and is ready to do the work then. A delay of a single day in preparing the land and putting in a crop will sometimes make all the difference between success and failure, and two or three days' waiting will often add many dollars to the expense of cleaning an acre. The gardener should visit and inspect every part of his garden daily and be ready to concentrate his force upon the part which most needs it. He should also have at his command extra help for times when it is needed.

Disposing of Garden Crops.—It is not enough to know how to grow good garden crops, for the profit will depend largely on the market and the success the gardener has in selling. It would be foolish for a man living several miles from a village to undertake to grow perishable crops which must be sold the day they are gathered. He may find such crops as sweet and Irish potatoes, melons, turnips, and squashes profitable, but he should not attempt to do a regular market garden business. I think any village of one thousand inhabitants will support one good gardener, and the best way to manage is to sell direct to the families, as, if you try to furnish them through the groceries, the commissions and goods that are allowed to become stale and unsalable will largely reduce the profits, and as the people will not get their vegetables fresh, the amount consumed will be greatly reduced.

If you intend starting in the business, notify all the families in your village some weeks in advance, either personally or by a printed circular, and as soon as your vegetables are ready, drive

around to their houses regularly every day or every other day. Take orders at each trip for the next. Always give good measure, and do not top out, so that they will think they are getting nicer vegetables than they are. Have every thing you sell in as attractive a form as possible. Be obliging, and carry the vegetables into the cellar or back shed if they wish you to, and try to establish a reputation for fair dealing. If you will do this, you can retain your customers as long as you wish.

Those living near a city can often grow tomatoes, melons, sweet corn, and other truck, and sell it at wholesale better than to try to market it themselves, and it will often pay to keep the larger part of the farm in grass, and buy grain and feed as much stock as possible in winter to furnish manure for the truck patch. To those who have a taste for gardening and are so situated as to have a good market, and who can command the help and manure needed, there is no way in which so large an income can be realized from a few acres of land. There is this advantage, also, that there is a regular cash income during the larger part of the year. If one engages in regular market gardening and grows early vegetables, such as radishes and lettuce, under glass, he should have no other business. But truck farming can be profitably combined on many farms with dairying, and where the farmer can establish a milk route and sell the milk from a half dozen or more of cows, he will find a largely increased profit from combining the two.

This system of truck farming will become more and more profitable as our population increases, and its adoption will enable many young men to remain on the farm who would gladly do so, but are led to go to the cities because they think it takes one hundred acres of land to furnish support for a family. In the following pages will be found directions for the cultivation of vegetables and descriptions of varieties.

DESCRIPTION OF VEGETABLES,

AND DIRECTIONS FOR PLANTING AND CULTIVATING.

Asparagus.—It is a matter of surprise that asparagus is so seldom found in the farmer's garden, for there is no vegetable

grown that will furnish so large a return with so little labor, and it is in use in advance even of early peas, and at a season when the scarcity of other vegetables makes it of great value. A bed properly planted will last a life-time. If only enough for family use is wanted, buy the plants, as in this way a year's time will be saved, but if you wish to plant largely for market, grow your own plants. Sow the seed in shallow drills, far enough apart so that you can work with a narrow cultivator, and thin so as to have them grow stocky. Give thorough cultivation and they will be large enough to transplant at one year old. One thousand or more good plants can be grown on a square rod.

For family use plant a row or two at the side of the garden. Plow the land deep as you can. It is best often to plow out a deep dead furrow, and coat it liberally with manure, and then plow back the earth till it is level. Set the plants two feet apart in the row and four inches below the surface, spreading out the roots evenly in all directions. For an ordinary family, a row ten rods long will be sufficient, but if the family is large, double the amount. If two rows are planted, set them four feet apart. Cover the row heavily with manure every fall, and as early in the spring as the land can be worked, fork off the manure and cultivate the rows thoroughly and then replace it. The plant is perfectly hardy and will not be killed by the hardest freezing, but it will start earlier and make a stronger growth if well protected through the winter.

The secret of large, tender shoots is plenty of manure, clean culture, and sufficient distance between the plants. Salt may be used on the bed in sufficient quantities to kill weeds, and will be of benefit to the asparagus. Cut sparingly the second spring, and after that it should be kept cut close till about the first of June. At the last cutting work thoroughly. The tops should not be removed in the fall till fully ripe. For field culture I would recommend that it be planted three by four feet apart and worked with a horse both ways. This crop is very salable, and bears shipping and handling well, and is very profitable where a market can be had for it. Peter Henderson says: "It is safe to say that in the vicinity of New York the net

profits from asparagus will average \$400.00 per acre. But two varieties are named in the catalogues, "Conover's Colossal," and "Giant," of which the first named is the largest and most profitable.

Beans.—In the chapter on miscellaneous crops the cultivation of the navy bean is treated. The best bush bean for the garden that I have ever seen is the black wax. To call it a string bean is a misnomer, for it is absolutely stringless. It is also tender and of excellent flavor, and is best when fully grown. The seed is a glossy black, and the pod a clear yellow. They are very prolific, and bear quite close planting. I prefer hills one foot apart, with three beans in a hill and the rows may be from eighteen inches to two feet apart. They are quite hardy, and the first planting may be made the latter part of April and every two weeks thereafter till the first of August. They are not suitable for shelling, for which purpose the golden wax and white kidney are the best.

Pole Beans.—As the poling of beans is expensive I would never plant pole beans if there were as good dwarf varieties, but none have been found that compare with the Lima. There are three varieties, the "Large Lima," the "Small Lima," also called the "Sieva," or "Carolina," and "Dreer's Improved." Of these, the second is best for family use, as it is earliest, most prolific, and easiest to shell, and it also takes to the poles more readily than the other varieties. The Dreer's Improved is the largest and best flavored of all; the seeds are not white when ripe, but of a pale greenish color, and are formed more closely in the pod than any other variety. All these varieties are excellent for winter use and can be grown at a profit for this purpose, or for sale. The most durable bean poles I ever saw are those cut from Osage orange hedges, as they are almost indestructible.

Any one expecting to engage in growing pole beans should plant a plot of black locusts to provide a supply of poles; they can be grown large enough in three or four years, and have not the objectionable thorns that the Osage has. Over ten thousand can be grown on an acre, and six hundred of the best left

for timber, and the bean poles will pay all the expense. In the chapter on "Timber Growing" directions are given for growing them. The beans should be planted in hills four feet apart each way, and the poles set at least a foot deep so that they will bear the weight of the vines. All the lima beans are tender, and should not be planted till the land is warm, say from May 15th to June 15th. For family use some weeks may be gained by planting a few hills in three-inch pots under glass, and transplanting to the open ground when the danger of frost is over. There is one other variety of bean which I find profitable to pole, the "Dutch Case-knife." It is early and very prolific, and is the best dry bean for winter use that I am acquainted with. It succeeds, also, very well on corn.

Beets.—The cultivation of field beets is treated in another chapter. For the garden, I prefer the turnip-rooted varieties, and the Early Egyptian and Improved Blood Turnips are the best. All the beets are hardy, and may be sown as early as the land can be worked, as the freezing of the ground after they are up will not kill them. Early sowing will give the largest yield, but a late sowing—about July 1st—will give a better and tenderer table beet for winter use. The largest yield of beets I have ever seen was from the Early Bassano. This is a turnip beet, light red on the outside, and marbled, with red within, and is recommended for fall feeding of cows, as on rich land, with good culture, they will grow enormously large. They are also excellent for the table when young, but not so attractive as the red fleshed varieties. For garden culture plant beets in rows fifteen inches apart, and thin to six or eight inches in the row. The thinnings may be used for greens the same as spinach.

Cabbage.—The varieties of cabbage are numerous. Many of our seedsmen describe in their catalogues from forty to fifty, but the farmer or gardener will ordinarily grow less than a half dozen. The Early Jersey Wakefield is the best and earliest variety, and for second early there is, perhaps, none better than the Winningstadt. Other good summer and early autumn varieties are Henderson's Summer, Fotler's Brunswick, and Stone-

mason. Often the grower will succeed best with these summer varieties for winter cabbage, by sowing the seed late in May or the first of June. For the main crop of winter cabbage, the Premium Flat Dutch succeeds better in most localities than any other, and on very rich land Marble Head Mammoth will grow the largest heads. The Savoy cabbages are wrinkled and grow a rather loose head. They have a more delicate flavor than other varieties, and are recommended for the South, where others do not head well. Red Dutch is used exclusively for pickling. It is very hardy, and forms a solid head, which keeps well. It is a late variety, and requires a rich soil for its perfect development.

The earliest cabbages are usually started under glass or in boxes in the house, but as the cabbage is very hardy, I succeed in growing them nearly as early and with much less trouble in the open ground. I mix a little Wakefield cabbage seed with the early radish seed, which I sow as early as the land can be worked, and as we begin to use the radishes, we pull first those near the cabbage plants, and by the time the radishes are too old for use we have a row of fine, stocky cabbages. Cabbage plants grown in the hot-bed are often spindled, and have long stems. When this is the case, they should always, in transplanting, be set in the ground up to the first leaf, no matter how long the stem may be. The gardener can often make the growing of cabbage plants very profitable. The earliest must be grown under glass, but if some are sown in the open ground in a warm, sheltered location as soon as the ground can be worked, there will often be sale for them. For winter cabbage make two sowings in the open ground, about the first and the middle of May. Never sow them near where you are growing turnip seed, as the garden flea breeds on the turnips, and when the seed is cut they will destroy the cabbages, even after they have attained a large growth. Very often the garden flea is as destructive to young cabbage plants as the striped bug is to melons, and the utmost vigilance will be required to save them. As soon as the plants are up so as to be seen in the row, they should be dusted with air-slaked lime, and this should be repeated every few days till

they are of good size. This dusting should be done when the dew is on. I have had a hundred thousand plants destroyed in a day by these pests.

Cabbage seed may be sown with the seed drill, and one ounce of seed allowed for each three thousand plants wanted. The plants may be grown in rows eighteen inches apart, and enough left in every other row to occupy the land and make a crop. The Marblehead Mammoth is said to do much better when grown from the seed where it is to stand, than when transplanted. Cabbages do best on heavily manured land, but thorough culture will, to some extent, make up for lack of manure. The summer varieties, sown late, will often head better on land that is moderately rich, than the large late varieties. Joseph Harris says, in speaking of the cabbage worm: "On my own farm I do nothing to check the ravages of the cabbage worm but to dust the plants when the dew is on with a mixture of plaster and superphosphate. I am not sure that it lessens the number of the worms, but at any rate it stimulates the growth of the plant. The only practical remedy I have ever tried is heavy manuring and thorough cultivation and setting out plants by the thousand instead of by the hundred."

Winter cabbages may be set out in July on the land which has grown peas and early potatoes. From five to seven thousand can be grown per acre, which, at ordinary prices, will give a handsome profit. Cabbages that have begun to head, but are not large enough to be salable at the close of the growing season, may be headed in pits during the winter so as to be solid in the spring. Select a piece of ground where there is no possibility of flooding, and dig a trench one spade deep and wide enough for four or five rows of cabbage set in as close as it is possible to pack them. There should be plenty of good soil and a little fine manure under them, and as each row is put in, the earth should be tramped on to the roots. They should be in beds not over four feet wide and as long as necessary. Set boards, a foot wide, on edge at the sides, and at the approach of winter cover the cabbage with leaves, fine hay, or cut straw, and then above this with corn fodder enough to keep out the rain,

arranged so that its weight will rest on the frame, or, if preferred, a larger quantity of straw or leaves can be used, and a roof of boards put over it; managed in this way cabbages that are worthless in the fall will grow a salable head during the winter.

Carrots.—In the chapter on “Root Crops,” I have given directions for growing carrots as a field crop. There should be a small bed of the early scarlet Horn planted in the garden, as they are useful for flavoring soups. As they are great yielders, and bear close planting, two or three square yards will suffice for the family. If there is a demand for them in market, it will pay to grow all that can be sold, as they are very profitable. Among the Germans they are in great demand.

Celery.—This plant is seldom found in the farmer’s garden. The reason for this is probably that a great amount of labor is supposed to be necessary in growing it. A family supply of celery can be grown with but little more labor than is required to grow an equal amount of parsnips, if properly managed. Peter Henderson says of it: “I know of no vegetable on the cultivation of which so much useless labor is expended, with such unsatisfactory results.” The best varieties are the dwarf, as they can be planted closer and will require less labor. I would recommend “Crawford’s Half Dwarf,” “Incomparable Dwarf,” and “Boston Market.”

Seed should be sown in the open ground early in April. The land should be rich and well pulverized, and the seed sown in drills wide enough apart to admit of the use of the hoe. Cultivation should be constant and thorough. Cutting the tops back once or twice with the shears induces a stocky growth, and enables them to endure transplanting better. Any time in July the plants may be transplanted to the garden, and may be set out where early peas or potatoes have been grown. Make the soil rich and mellow, as it will require but little land to grow a family supply, and the more rapid the growth, the better the quality. Plant one foot apart each way and give thorough cultivation, and plenty of water if the weather is dry. This close planting will induce an upright growth, and no banking or earthing up will be necessary; but a longer growth can be had by set-

ting boards a foot wide on edge, at the sides of the bed, and filling between the plants with earth. The last of October take up a part of the plants and put in the cellar to blanch for use, and the middle or latter part of November the remainder.

Celery will endure sharp frost without injury, but should never be handled when frozen, and it should not stand out till the ground freezes. To blanch it and keep it for winter it can be put in old barrels or narrow boxes. Put a few inches of mellow earth in the bottom and set the roots in it, pressing the earth to them as if transplanting it, and set in the cellar. It may be packed in quite closely, and from twelve to twenty plants can be put in a barrel. If you have more than you wish to put in the cellar, a part can be kept in trenches. Dig as narrow as you can—not to exceed twelve inches—and as deep as the length of your plants. Place the celery in the trench as nearly perpendicular as you can, and as closely as it can be packed. No earth will be necessary except what adheres to the roots. It should always be handled when dry. It will need no covering for a few days, but the material should be on the ground so as to be ready for use, and should be added gradually as needed. The cleanest and best material is sawdust, and a load of it will protect a large amount of celery. If kept dry, eight or ten inches of sawdust will keep out the frost in the coldest weather, and there should always be a covering of boards, corn-fodder, or some other material, to keep the sawdust dry. The reason for making the trenches narrow, and covering gradually, is to prevent the celery from heating, which would cause it to decay. The celery after being placed in the boxes or barrels in the cellar or in the pits, will be fit for use in five or six weeks, and will remain in good condition till spring.

Following the directions here given, the growing of celery is so simple that there is no excuse for any family being without it.

Sweet Corn.—The growing of corn is an easy matter if one has a rich soil, and sweet corn will be found a profitable crop for the truck farmer. In the family garden I would advise that the first planting be made early in April, or as soon as the

ground is warm. Probably three years out of four you will save this early planting and gain a few days' time. Do not wait to see if it is killed before making a second planting, but plant again a week later, and at this second planting plant an early and a late variety. All the varieties of sweet corn require a rich soil, and especially the quick maturing kinds.

I think a thousand dozen ears of the larger varieties can be grown on an acre, and the smaller kinds can be planted much closer. Plant the larger varieties in rows three and a half feet apart, and the stalks one foot in the row. This will give over 12,000 stalks to the acre, and it is safe to estimate that one-fourth of them will bear two ears. The small early varieties will bear much closer planting—rows three feet and stalks six inches, which would make over 28,000 stalks to the acre. Late corn I usually find the most profitable, and it can be planted after early peas or a crop of turnip seed has matured. In my latitude, the last week in June and the first in July is the time we plant the late crop, using the large varieties, as they sell best.

For family use the early varieties may be planted two weeks later. Where dairying and truck farming are combined, sweet corn is a very profitable crop, for the fodder will pay all the expense, and all the corn sold is clear profit. The earliest varieties are, Early Boynton—also called Tom Thumb—Marblehead, Early Minnesota, and Early Red Narragansett. These varieties will be fit for the table in from eight to ten weeks from planting, varying with the weather and time of planting. Stowell Evergreen is the standard variety for the main crop, and the one grown almost exclusively for the canning establishments. The ears are large, and it is sweet and tender, and remains for some weeks in good condition and produces heavy crops. Mammoth Sweet is a large and very excellent variety, sweet and tender, and with ears as large as field corn. Amber Cream is a productive, vigorous variety, which endures drought better than most kinds, and is of excellent flavor—a good family variety. There are a score more of varieties, but those named I believe to be the best.

Pop-corn.—When a contract can be made for its sale, or

you are sure of a market, pop-corn will be found a profitable crop. It bears quite close planting, and much of it will produce two or more ears to a stalk. As it comes up rather weak, and does not require a long season, it is best to defer planting till the weather is settled and the land warm. For family use I prefer the Rice, which has larger ears than the common white, and pointed kernels. It is very tender and sweet. When growing for market you must grow that which will sell best.

Cucumbers.—The best varieties of cucumbers are Early Russian, White Spine, Early Frame, Early Cluster, and Long Green. If I was to choose one of these for all purposes, I would take the Cluster. Probably the White Spine or Long Green is nicer for slicing, but the Cluster makes the best shaped pickle, and begins bearing very young, and does not mat the ground with vines as the Long Green does. The earliest cucumbers are usually grown in the hot-bed, one hill being planted to each sash, after the earlier grown plants have been pulled out. For the open ground they may be started in three-inch pots in the hot-bed and transplanted after the weather has become warm and settled. Another way in which some weeks may be gained, is to use a bottomless box a foot square, at each hill. Settle the boxes well into the ground and tip them to the south, and have a piece of board to cover each in case of a cold rain or night. For the earliest planting a single pane of glass can be used on the box. These boxes will be a protection not only from cold, but also from the striped bug.

To grow a profitable crop of cucumbers plenty of manure and thorough cultivation is necessary. It is best to manure both broad-cast and in the hill. I grow them very successfully after early peas. The main crop for pickles may be planted from June 15th to July 10th, and they will rarely be troubled by the striped bug after the first-named date. The best soil for cucumbers is a black, loamy clay, and I think they will produce double on this that they will on an equally rich soil which is of a lighter color and heavier. The plant requires a great deal of heat, and the black soil absorbs much more heat than the lighter colored one. The land should be put in good order and laid off

five feet apart each way. A large shovel full of fine manure to a hill is none too much. It is best to mix the manure with the earth, and there should be three or four inches of earth above it. The hill should be made four to six inches above the level, or the plants will be too low, for in planting you want to brush off two inches of the hill, so as to drop the seed on fresh, moist soil, and then step on it so as to press it firmly into the soil, and this will settle the hill two or three inches more. All the covering they will need when treated in this way will be a little fresh earth, and a slight motion of the foot covers them. An acre can be planted in this way in less than two hours. As the vines will run in about five weeks so that they can no longer be cultivated with a horse, it is best to cultivate often; twice a week is not too much. As soon as fairly in the rough leaf, thin to four plants, leaving those most stocky, and as well scattered as possible. If weeds start, or a heavy rain packs the soil after the vines have run so as to prevent horse work, it will pay to hoe the ground over lightly. At the final working I always sow turnips, as they do not interfere with the vines in the least, and will make a fine crop after the cucumbers are done bearing. I very seldom fail in getting a good turnip crop on my cucumber land.

If the weather is good you can begin gathering pickles in six weeks from planting, and if warm, they must be picked every day, but cold nights will soon check their bearing. If you are growing largely, it will pay to have a foreman for each five or six pickers, to follow and see that they are picked clean and to empty the baskets. The vines should never be lifted or disturbed any more than necessary, and boys and girls with bare feet will tramp the vines less than men with heavy boots. The cleaner they are picked, and the more carefully handled, the longer they will continue in bearing, and every cucumber should be removed from the vines. If any were overlooked the previous day, and are too large for pickles, cut them and throw them away, for if left to form seed, they will take all the strength of the vine, and it will stop bearing. The pickles should be assorted, the small ones, those from two and a half

to three inches long are the most salable, and a barrel will hold from four to five thousand of them. The price at the factories varies from one dollar to one dollar and a half per thousand, and at these prices the crop is quite profitable.

Lettuce.—This plant is very hardy, and may be sown in the fall and protected with evergreen brush or any light covering. If sown in spring, put the seed in as early as the land can be worked. To grow crisp, tender lettuce, the land must be very rich and in high cultivation. It is a profitable crop to grow under glass for a city market. If you expect large, well developed heads, it must be thinned early, before the plants have become spindled. Thin to a foot in the row for the large varieties. There are many farmers who have never seen or eaten good lettuce, because they allow the plants to be so crowded that they do not develop perfectly. On rich soil, with plenty of room and good culture, any of the large varieties may be grown so that one plant will be sufficient for a meal for a family of ten.

The varieties are numerous, but a few will be sufficient for the family or market gardener. Among the best kinds are: Early Tennis Ball, Simpson's Early Curled, Early Curled Silesia, Large Drumhead, and Prize Head. The last named is the best summer variety I have ever seen, and the handsomest plant. It is slow to run up to seed and is wonderfully crisp and tender.

Melons, Musk.—The same general directions given for growing cucumbers, will apply to musk-melons. There is no danger of getting the land too rich, or of cultivating too thoroughly. Plant a little wider than for cucumbers. Five feet each way will give over seventeen hundred hills to the acre, and the Nutmeg varieties will usually yield eight or ten melons to the hill, and if they can be sold at an average of two cents each, a good crop will pay a large profit. The greatest trouble with melons of all kinds is to get a stand early enough in the season, as the striped bug is nearly sure to visit them.

By constant watchfulness and care and using plenty of seed a stand can be secured. Make the hills rather broad, and elevated three or four inches above the level, so that a heavy rain

will not flood them, then with the finger or a stick draw a mark through the center of the hill each way, dividing it into four equal parts. Plant the southwest quarter of the hill as soon as the land is warm, which will be often in this latitude the last week in April or the first in May. Three or four days later plant the southeast quarter, and follow round till you have made four plantings. About one dollar's worth of seed and a day's work to the acre will be the cost of these three extra plantings and you will be almost certain to save one of them. If your soil is heavy, I advise that a large shovel full of sand be put on the top of each hill before planting.

As soon as the plants begin to come up visit the patch every day and carefully inspect it, and when a hill is fairly above ground, apply a handful of bran to it; dust it thickly over the top of the plants and heap it around the stem till it touches the leaves. It will often save them from the bugs, and besides is a good fertilizer. Rev. L. L. Langstroth, who is a careful experimenter in every thing that regards insect life, recommends that gritty turnpike dust be used. It should be sifted and then applied liberally when the dew is on, and should be applied to the stems and under side of the leaf as well as the top. These applications should be made as soon as the plants are fairly above ground, whether any bugs are to be seen or not, for prevention is much better than cure. After the bugs once get on a hill of melons, it seldom thrives, for if they do not kill it they poison it and leave it unthrifty.

Any thing that you can do to hurry the growth and increase the thrift of the plant will be a help and shorten the time of danger, for as soon as fairly in the rough leaf the plants are safe. A handful of fine, rich manure near the surface will hurry the plants, but if superphosphate or chicken manure is used, it must not come in contact with the seed, or it may destroy it. Cow manure pulverized so that it can be sifted is excellent for this purpose. It will pay for the first ten days after the melons come up to work them every other day, and the best implement I have ever seen for this purpose is the Excelsior Hand Weeder. With it you can loosen the soil be-

tween the plants and work in a little fine manure if desired without disturbing them. If melons are managed as here recommended you can hardly fail to get a stand, as if one planting is eaten up by the bugs you have others coming on to take their places.



EXCELSIOR HAND WEEDER.

The green-fleshed, netted varieties are the most prolific and salable. Jenny Lind is the earliest, but is too small to be profitable for market. Green nutmeg is the popular market variety. Bay View and Cassaba, are large, green-fleshed varieties, the former often growing to a length of sixteen or eighteen inches. Early Yellow cantelope and Long Yellow are yellow-fleshed.

Watermelons.—The same general directions given above will apply to the management of watermelons, but they should be planted much wider apart, not less than eight by ten feet, and as soon as the vines are four or five feet in length they should be covered with earth about two feet from the hill, so as to enable them to take root. Next to the striped bug the evil most common with watermelons is premature dying of the vines, and if we can cause the vines to strike root at some distance from the hill it will be a preventive of this trouble. The best time to cover the vines is as soon after a rain as the land will work nicely. With the corner of the hoe make a furrow three inches deep alongside the vine, and carefully lift it into it. Then fill the furrow with fresh mellow earth, and with the foot press it firmly. If large melons are wanted, but few specimens must be allowed to grow on a hill, and the ends of the vines nipped a few joints beyond the fruit. Another cause of vines dying prematurely is that the manure used in the hill is not sufficiently mixed with earth.

The directions given for planting melons are often erroneous. The planter is told to dig a hole two feet in diameter and twelve to eighteen inches deep and fill it with manure; if this is done the vines are almost certain to perish when the weather becomes hot and dry. The same amount of manure spread over

a space six or eight feet in diameter and thoroughly worked into the soil will be of greater benefit to the vines. A gallon of fine, thoroughly rotted manure is enough for a hill, and it should be partly mixed with the soil. Although I use the term "hill" I do not recommend that it should be elevated much above the level of the field; an inch or two, so that there is no danger of the hill flooding, is better than a high hill. The earlier you can get thrifty vines started the better, but if for any cause you have no early vines, I would plant any time in June. I usually pick ripe melons in twelve weeks from planting when it is deferred till the weather and land are warm, and often vines planted from the first to the fifteenth of June are ahead of those started a month earlier.

Phinney's Early, Peerless, Mountain Sweet, Mountain Sprout, and Cuban Queen, are the leading varieties. Of these the Peerless is the finest flavored. It has small, white seeds and a scarlet flesh solid to the center, and very sweet. Phinney's Early, small drab seeds, and scarlet flesh of excellent quality. Mountain Sweet, seeds mahogany color and rather large, flesh scarlet, solid and delicious. All three of these varieties are superior for family use or a home market, but all have such thin and brittle rind, that they are not suitable for shipping. Mountain Sprout has the qualities for shipping. It is of large size, scarlet flesh, a good keeper, and bears carriage well; seeds drab. Cuban Queen is the largest melon grown. Specimens have been produced that weighed over eighty pounds. The vine is vigorous, requiring wide planting, flesh red and of fine flavor. It bears shipment well.

Onions and Potatoes.—As onions and potatoes are field rather than garden crops, they are treated in the chapter on "Root Crops."

Parsnips.—As far as a market can be had for them there are few crops that will give a better profit than parsnips. They start with a much stronger growth than the carrot, require less hand weeding, and will yield as many bushels to the acre. Another advantage of the crop is, that it can be left in the ground all winter without injury. They will be found a profit-

able crop to grow for feeding to stock, in the spring, as five hundred bushels can be grown on an acre, and on rich garden soil this has often been exceeded by one-third.

Planting should be done early, but not until the ground is in good condition. If the soil is heavy it will pay to use sand to cover the seed, as the plants are not strong and can not lift a heavy, packed soil. For the same reason the seed should be sown thickly, so that they will help each other through the soil. Before they become spindled, thin to about four inches, or, if your land is not very rich, six inches. Be particular that the plants stand singly, as you can not grow good shaped roots if crowded. After the first hoeing, most of the work of cultivation can be done with the horse, if the rows are twenty inches apart. The best implement to use is a single shovel plow, with a long, narrow shovel, or bull-tongue, as it is called. If planted as close as recommended, the plants will shade the land and keep the weeds from growing, after the middle of June. It is important that clean land be selected for the crop, and that it be made deep and mellow. Fall plowing of the land into beds sixteen feet wide will give good satisfaction, for although you will lose a row or two where the dead furrows come, the deepening of the soil and the good surface drainage will more than compensate for it. Deep fall plowing will give cleaner land, if weeds have been allowed to go to seed, as most of the seed will be turned down so deep as to prevent its germination, or at least to retard it until the crop has a good start.

Although the crop will keep perfectly in the ground, it is wise to dig and pit a part of it, so that it will be accessible in frozen weather, as there will often be a good demand and high prices at such times, and the gardener who can market his crop will realize a large profit. Peter Henderson once realized nearly eight hundred dollars from a half acre, by being able to market his crop when the ground was hard frozen. Any vegetable that is to be marketed from pits in the winter should be covered with corn-fodder, straw, or coarse manure, so that the ground over them can not freeze. A small load of corn-fodder can be stacked over a pit containing a hundred bushels of roots,

so as to protect it from freezing, and without any damage to the fodder, which can be taken to the barn and fed in the spring. There are but few varieties of parsnips. The Long Dutch or Sugar, and Hollow Crown are those usually grown, and on my soil I have never been able to detect any difference between them.

Peas.—These are a valuable garden crop, either for market or the family, as they can be had early, and by judicious selection of varieties and successive plantings, the season can be prolonged for many weeks. The soil can not be made too rich for the small, early varieties, nor can they be planted too early. The tall, later varieties will bear good crops on land only moderately rich. For early peas always plow and manure the land in the fall, and sow as soon as the land can be worked. In my latitude the earliest I ever sowed was February 23d, and the earliest date at which we have had them for use, May 23d, and in backward seasons it is sometimes as late as June 8th or 10th before we get the first mess. The early, smooth varieties should be used for the first planting, as the wrinkled kinds are not so hardy.

We have now so many excellent dwarf varieties that I do not plant those which require sticks. These varieties may be planted very thick, rows fifteen to eighteen inches apart, and a pea to the inch, in the row. Planted in this way I have often gathered a bushel in the pod, to the square rod. At a second planting, about the first of April, plant again of the early kinds, and at the same time some of the large, late varieties. A third planting, about the middle of May, should be made of late kinds, as the early ones do not do well during the heat of summer. My diary shows that a planting of Champion of England and Marrowfats, made May 16th, gave a supply from the middle of July till into August. I have not bushed a pea for years, and never expect to again, for even the tallest varieties will produce a fair crop without it. They grow up about three feet high and fall down and form an elbow, and grow up again and produce a crop. You will not get as many peas as if you stick them, but land is usually cheaper than the labor. Two rows,

twelve rods long, without sticks, furnished a family of ten with all they could use while they lasted. I have been told by market men from Boston and New York, and also London, England, that the tallest varieties are never bushed.

The best dwarf varieties are: Tom Thumb, McLean's Little Gem, Blue Peter or Blue Tom Thumb, and American Wonder. The Tom Thumb is a little the earliest, and the American Wonder the best flavored. It and McLean's Little Gem are wrinkled varieties. There are several early varieties which grow from two to three feet high, such as Daniel O'Rourke, Early May, Early Philadelphia, etc., but none of them possess any greater merit than the dwarf kinds named above, and as these bear closer planting and can be gathered much more rapidly, I give them the preference. For the late, tall growing varieties, the Champion of England and Marrowfat I have never found surpassed. The Sugar pea with edible pod, is thought by some desirable for the private garden, but is seldom grown for market. About two bushels of seed of the dwarf early kinds is required for an acre, but as the tall kinds must be planted in wide rows and not so thick in the row, one-fourth as much seed will be sufficient.

Peppers.—Mango peppers are in considerable demand, and are a profitable market crop; they are usually sold green by measure or count. They should be started early in hot-beds and set in rows wide enough to admit of horse culture, and about fifteen inches apart in the row. The Bull Nose, or Bell, Squash, and Sweet Mountain are the varieties most commonly grown. The small, pungent Cayenne Pepper requires the same treatment, but may be planted much closer. They are usually pulled up by the roots and sold in market on the plant.

Radishes.—There are few garden crops that will give so large a profit from a small amount of land as radishes. The land should be plowed in the fall for the early crop, and if heavy should have a liberal dressing of sand, or of leaf mold from the woods or both. The manure should be fine and spread over the surface in the fall, and it will pay to dress with superphosphate. Well-rotted chip dirt is one of the best fertilizers for radishes. The quicker a radish can be grown, the sweeter and

tenderer it will be. The earliest sowing may be made as soon as the land can be worked; but as these are sometimes killed, sow again in a few days, and every two weeks for a succession. The best varieties are French Breakfast, Early Olive-shaped, Long Scarlet, and White and Scarlet Turnip. We have, also, several varieties of winter radish, which may be sown in August and used through the winter. The best of these are the Chinese Rose, Chinese White, California Mammoth, White and Black Spanish.

Rhubarb.—Whether for the family or market, rhubarb is a valuable crop. It comes into use earlier than any other product of the garden, and at a season when the system craves something tart. The land should be plowed as deep as possible, and made very rich for this plant, and it should be covered with manure every fall so as to protect it from frost, and enable it to start early in the spring. The crop is a profitable one and will bring several hundred dollars per acre. The common method of propagating is by subdividing the roots, but after many years experience in growing it from seed, I would recommend this method: Seed should be sown in May in a rich, fine soil. If thoroughly cultivated, the plants will usually grow large enough by fall so that good sized stems for table use can be had from them, and if not transplanted will yield a half crop the next spring. If transplanted it is best not to use from it till the second year. The plants may be grown within six inches of each other in the nursery bed, but should be thinned to four feet the following spring. Rhubarb may be had very early in the spring if well covered with manure in the fall, and about the middle of February the manure is removed from the crown and an old barrel, with both heads knocked out, placed over it and banked round the outside with warm, fresh manure.

The varieties most in use are the Linnæus, Victoria, and Cahoon. The first named is the earliest, and is of excellent flavor, and less acid than any other. The Victoria is later, but very large, and is the most profitable for the main crop. The Cahoon is a large, late variety, and was extensively sold under the name of Wine Plant some years ago.

Salsify.—This is also called Vegetable Oyster. It is seldom grown, but as its cultivation is easy, and it is healthful and delicious when properly cooked, it should be oftener found in the garden. Its management is precisely the same as the parsnip, and like it can be left in the ground all winter. It is cooked like the parsnip, and is also used in soups, to which it gives a decided oyster flavor. There is but one variety.

Spinach.—No vegetable is more easily grown than this, and yet it is not found in one garden out of ten among farmers, but all market gardeners know its value, and find it a very profitable crop. It is very hardy, and may be sown in the fall if lightly protected with evergreen brush, leaves, or straw, or it may be sown as early as the land can be worked. A second sowing may be made two weeks later. It makes delicious greens, and a very small bed will supply a family. It runs up to seed early, and as soon as past use, the land should be cleared and some other crop sown. There are two varieties, the Round and Prickly Seeded, but the first named is the best.

Squash.—The summer squashes are of easy cultivation. They require a rich soil and good culture, and it will pay to use a gill of superphosphate in a hill, as it gives them an early start; it must not come in contact with the seed, but should be thoroughly mixed with the soil. Most of the summer varieties do not run, and may be planted four feet apart. There are two varieties, the Crook-neck, which is yellow and covered with warty excrescences, and from seven to nine inches long, and is considered the best flavored, and the Scalloped. This variety is grown exclusively at the South, where they are called Cymbals. There are two colors, white and yellow.

Squash, Winter.—We have several good varieties of winter squash, among which are the Boston Marrow, Turban, Hubbard, Marblehead, and Winter Crook-neck. I find the Hubbard the best for market, and the Crook-neck the most profitable for stock. One point in favor of growing squashes is that they can be grown after early potatoes, and make a full crop, and so cost nothing for ground rent. I have never been successful with the Hubbard squash when planted alone, as the striped bugs would

always destroy them. Whether the bugs do not find them among the potatoes, or there is something about potato vines that is distasteful to them, I do not know; the fact remains that I have never had them disturbed when planted in this way. The crook-neck squash is more hardy, and is seldom disturbed by the bugs, and may be planted after early peas or among sweet corn.

Squashes do not require a long season, and may be planted the latter part of June. My "Hubbards" were planted this year the 26th of June, and on September 20th, twelve weeks from planting, were matured so as to be out of the way of frost. During the three weeks ending August 14th, one of these vines ran fourteen feet. Wherever a market can be had for them the Hubbard squashes can be made very profitable, as they are excellent keepers and can be marketed at any time during the winter. Care should be taken in gathering them to cut the stem and leave most of it on the squash, for if broken from the squashes they are likely to rot. They should also be handled carefully so as not to bruise them. They should be stored where the temperature can be kept uniform, and forty degrees is the best temperature; but some range is allowable. Enough for family use can be kept in a dry cellar, but when grown in large quantities for a winter market, they should be stored in a room where fire can be made in damp or very cold weather. If they are to be put in the cellar, it is best to keep them in an upper room or out-building for a few weeks first. They should always be gathered when perfectly dry.

Tomatoes.—To have this crop early requires starting in the hot-bed. The seed may be sown quite thickly, about the first of March, and the plants, when about four weeks old, pricked out into other beds, setting them four or five inches apart. Enough plants can be started under one sash to fill fifty when transplanted. By giving plenty of room, these transplanted plants can be kept in the hot-bed till they are in blossom, and then if watered copiously the night before, and taken up carefully with a ball of earth, they will be checked but little in their growth, and will fruit quite early. I can get ripe tomatoes early in July by this treatment. For the main crop this trouble

and expense is not necessary, but the seed may be sown in a cold frame the middle of April, and no sash used. Boards or mats must be provided, however, to cover them in case there is danger of frost. The plants must be thinned so as to prevent them from becoming spindled.

The main crop may be grown on ordinary land—by which I mean that rich garden soil is not necessary—by manuring the hills well. It is claimed by those who grow the crop largely for the factories, that they bear better on rather thin land, the manure giving the plant a thrifty start, and when the roots extend beyond it and reach the poor soil, the check in its growth induces fruitfulness. From two to four hundred bushels to the acre can be grown in field culture, and I have known market gardeners, by extra care, to sell an average of a bushel from each plant on a plot containing several hundred plants.

I would never plant closer than four feet apart each way, and on rich soil they will cover the ground if planted five feet. In growing them largely it is wise to leave a road for the wagons every ten rows. The roads can be used for growing some early-maturing crop, so that the land need not be idle. The advantage of this is that you need not carry the tomatoes far, and as they are very heavy, this will be a great relief in the labor of gathering them. The first week in June is seasonable for planting the main crop, and as it often happens that the late gathered fruit brings a high price, it is wise for the gardener to plant late as well as early.

There are few garden products that vary more in price than tomatoes, the earliest bringing almost any price you may ask for them. In the flush of the season the market is often glutted, and the price is sometimes down to twenty-five cents a bushel. At forty cents they are a profitable crop, and as the very early and late ones will sell high, the average price will usually be considerably above forty cents. New varieties have been brought out nearly every year, with claims that they were earlier than any that had preceded them, but on trial, very little difference in this respect is found among the leading varieties, the earliness depending more on the treatment the plants

receive than the variety grown. If I was confined to one variety I would choose the *Acme*, as it is early, large, and prolific. It continues to bear till frost, and is invariably round, smooth, and of good size. It ripens evenly and bears shipping well. Among other desirable varieties are, *Hathaway's Excelsior*, *Early Large*, *Smooth Red*, *Essex Hybrid*, *Paragon*, and *Trophy*.

Turnips.—You will find the cultivation of the flat turnip described in the chapter on "Root Culture," but as the *Ruta Baga* or *Swede* turnip is usually grown as a garden crop, it is treated here. They require a rich, well-worked soil. In addition to stable manure, it will pay to use some superphosphate, as this is especially adapted to the turnip. It is well to seed heavily, as the garden flea, the same that destroys cabbage plants, often attacks them. As soon as they can be seen breaking ground, apply plaster to them, and repeat after each rain.

The seed should be sown in May or the first of June, in rows far enough apart to work with the horse; about two feet will answer. They may be sown on level land or in low ridges; in the latter case they must be thirty inches apart. As soon as they are in the rough leaf thin to ten or twelve inches in the row. They will need to be thoroughly cultivated, and under favorable circumstances will yield one thousand bushels to the acre. The best time to market them is in the spring, as they are excellent keepers and will be in good condition after the flat turnips are past use. They can be wintered in pits as described for other vegetables.

CHAPTER XIII.

INSECTS INJURIOUS TO THE FARM, GARDEN,
AND ORCHARD.*

THE present chapter is arranged with the express desire that it may become a practical aid to the agriculturist. It is intended solely as an insect manual to the farmer, gardener, and fruit-grower, which shall give all possible information as to the best means to ward off insect enemies, and will be pruned of all scientific terms and technicalities not absolutely needed for the accomplishment of the desired end. It is greatly hoped that in spreading this information broadcast *all* our tillers may be stimulated to practice the measures recommended, for without concerted action to the fullest extent, this important problem of insect injuries can never be perfectly solved. Will not every farmer into whose hands it may fall, every grange, club, and society, horticultural and agricultural, if only for selfish ends, see that every farmer in the vicinity procure it, and then all work together to make it in the largest degree useful?

Those insects which attack our field crops are first considered, next the insect pests of our gardens, and lastly, the enemies of our orchards and vineyards. In each division the insects are considered somewhat in the order of their importance.

The scientific name of each insect will be placed in a parenthesis, and can be passed over when desired.

In the preparation of this manual, free use has been made of the valuable reports of Messrs. Riley, Fitch, Le Baron, and Walsh; the *American Entomologist*, "Practical Entomologist," and the important works of Harris, Curtiss, Packard, Saunders, and Treat.

*By PROFESSOR A. J. COOK, of the Michigan State Agricultural College.

The illustrations are mostly from drawings made by Professor Riley, and so need no praise.

When we remember that more than one hundred insects attack the apple tree, we see how impossible it is to treat of them all at this time. Only the more destructive can receive attention. In lieu of fuller information our readers are referred to Packard's Guide to the study of Insects, Harris' "Injurious Insects," Saunders' "Insects Injurious to Fruits," and "Injurious Insects of the Farm and Garden," by Mrs. Treat. All of these works are well worth a place in the library of every practical agriculturist.

Colorado Potato Beetle.—*Doryphora 10-lineata*, Say. Order, *Coleoptera*. Family, *Chrysomelida*. From the importance of the potato, the prevalence of this insect, and the extent of its ravages every season, it deserves a first place in our discussion. Though in this case we have a very cheap and perfectly effective remedy, still, actual observation and the high price of potatoes prove that barely half our farmers make use of it. There can be no doubt that should this article induce all our farmers "to fight the potato beetle by the most approved method," it would add greatly to the agricultural wealth of the country.

HISTORY.—The history of this beetle, that it is a native of Colorado, where it was discovered, named, and described by Say, many years ago; how, on a bridge of potato vines, it invested our Western States less than a score of years since, and from thence spread rapidly eastward till it now has actually gained our Atlantic coast, where it only awaits opportunity to take passage for Europe, where it will continue its dreaded ravages in the green fields of the Emerald Isle,—all this is already well known.

NATURAL HISTORY.—The natural history of the potato beetle is also familiar to most of our farmers. It comes forth out of the earth as a beetle just as the potato vines are peering from the ground. Sometimes, as the creature stands over the hill, it seems fairly to grin in expectant longing for the rich, tender feast which nature is about to spread. With the coming of

warm days the female (Fig. 1, *d*) lays her clusters of orange eggs (Fig. 1, *a*), sometimes to the number of a thousand—a single beetle which I confined laid over eleven hundred eggs,—either on the under side of the leaves of the potato vines, or on blades of grass or other vegetables near by.

These soon hatch, when the young or larvæ (Fig. 1, *b*) are found to eat quite as voraciously as the mature beetle. In about fifteen days the young become fully developed, when



FIG 1.—*a*, Eggs. *b*, Larva. *c*, Pupa. *d*, Imago. *e*, Wing-cover, magnified. *f*, Leg.

they pass into the ground to pupate (Fig. 1, *c*). After about ten days of such quiet they come forth in the beetle state, and from their freshness it might be thought that the old-time beetles had been absent to get a new suit, and had just returned to show their finery.

These beetles, with their bright bands of yellow and black, mate, deposit eggs, and soon die, behaving in all respects as before. So, too, the larvæ and pupæ. These again are followed by a third brood, which completes the ruinous work of the season; but the pupæ of this last brood do not come forth in ten days, nor do they die; but, resting quietly beneath the earth, seem to be gathering strength for a miserable repetition of the previous year's abomination.

WILL THEY REMAIN WITH US?—It is hoped by many that these incorrigible pests will not be long among us, reasoning from analogy, as many insects (like the Hessian fly) have been quite

as destructive for a time, and then have almost entirely vanished. We may reasonably hope that the insect enemies of this beetle, which are rapidly increasing, will lessen its numbers yearly; but that we shall ever be rid of it is reckoning without our host. It will probably remain with us for all time, though as its natural enemies become more numerous they will doubtless hold it in check so that some years the evil will be very slight. Still it is safe to conclude that we shall have to be ever ready to give it battle, and well may we be grateful that such efficient weapons are at our command.

REMEDIES.—Inasmuch as Paris green is so practical, so efficient, and so cheap a remedy for this pest, I shall, in this place, do what every farmer had better do on his farm—ignore all other means, such as hand picking, machinery, etc., as too expensive, and not sufficiently thorough. Paris green, or London purple, which is just as efficient, are entirely safe if care is exercised in their use, and are sovereign remedies. As these arsenites are very useful as specifics against many other noxious insects, I will give the methods of application once for all. The poison may be used dry, when it may be mixed with plaster, one part to twenty, or even fifty, of the adulterant, or if the weather is wet and rainy, mixed with flour, one to eight, and put on when the plants are dry, and in such small quantities as just to show on the plants. The quantity is sufficient to kill the insects, though the amount is so small as not in the least to injure the vines. The flour with the first dew, forms a paste which can not be washed off by even a heavy rain. This is sifted on when there is no dew on the vines, either through a muslin bag suspended to a convenient handle, that it may be carried and shaken over the vines, the person making the application walking upright, or with a pail, the bottom being of fine wire gauze or finely perforated tin. Another way to apply the arsenites is to mix with water, one pound to one hundred gallons or an even table-spoonful to two gallons. This is a mixture, not a solution, and as the poison tends to settle, must be frequently stirred. To apply this we may use a common sprinkler with a fine rose, or a Whitman's fountain pump. This pump is very

excellent for spraying trees, and can be used with good success even in spraying potato plants.

The advantages of the water mixture are ease, safety, even with the careless, and rapidity of application, and that, too, even if the day is windy. Its disadvantages are waste of material, as nearly one-third of the water does not touch the vines, and of course is lost; danger of not stirring the mixture sufficiently often, when the green, being only held in suspension, not dissolved, settles to the bottom, and the preparation becomes too dilute; ease with which the green when thus applied is washed off by heavy rains, and the danger of not applying evenly, as the powder suspended in the water is amassed wherever the drops of water settle. Yet from its convenience, and the ease with which the application may be made, this will quite likely be the favorite method.

After careful experimenting, I have found the flour mixture preferable to all other preparations. The flour makes the green adhere to the vines so that the heaviest rain is powerless to remove it. No second application is needed till enlarged growth of vines demands it. I make the mixture strong—one of powder to eight of flour—so that in making the application we need add only just enough of the mixture that we may be able to see it on the vines. The danger of using the flour mixture consists in the fact that unless used sparingly, the paste will destroy the vines. But it is perfectly easy and entirely safe to use it if the least possible amount be used. I repeat, add only enough that it may be seen.

I have thus been enabled to safely apply this mixture even to our tender melon and cucumber vines. I would not apply it when the dew is on, as the application will be more even if the vines are dry, and with the strength recommended above will always prove effectual. I think this is the most economical method yet recommended. By using the flour mixture I have found that two applications are always sufficient for our early varieties, and frequently for later ones; and three applications are in any case all that are needed, even in seasons of heaviest rains. Some prefer to use plaster instead of flour, using forty

or fifty parts of plaster by measure to one of the green. This does not form a paste, and can be added in quantity without danger to the vines—indeed the plaster may be useful—but the first heavy rain will wash it off.

ENEMIES.—I might enumerate and describe the score or more of natural enemies, birds and insects, which attack and destroy this potato beetle; but as they will not for long years, if ever, make the use of the Paris green unnecessary, and as this article is only to deal with practical problems, I will omit this interesting part of the subject.

Cut-worms.—*Agrotians*. Family, *Noctuidæ*. Order, *Lepidoptera*.—Little, if any, inferior to the potato beetle in its destruction to our field crops is the cut-worm. The cut-worms (for there are several species which claim tribute from the grain-grower), are not confined in their operations to a single staple, for nearly all our cereals, grasses, and especially our corn crops, are made to contribute to their support.

The cut-worms are so named from their prodigal habits of cutting off plants; not taking their fill on a single plant, leaving all uneaten undisturbed, but, as if totally depraved, rejoicing in rioting and wantonness, they simply cut the plants asunder, thus ruining every plant that they attack.

These destroyers are called surface caterpillars in England, doubtless from the fact that they lie concealed by day just beneath the earth surface. In Europe they are dreaded from their effect on grasses, and such injury in this country, though less patent than that done to corn, is by no means inconsiderable. In Europe the loss of a third of a crop is ruinous; here it is common, and hardly causes comment.

The cut-worms are no foreigners, “being to the manor born.” Even the Indians found in them a foe fully as persistent if not as formidable as the white man.

NATURAL HISTORY.—The natural history of these insects



FIG. 2.—*Agrotis Subgothica*.

(and this will apply to those which ravage our gardens and orchards as well as those attacking field crops), is as follows: Some time, usually late in the season, the moths, which are always of a sober hue, gray or brown, with two conspicuous spots on their front wings, may be seen in concealed places about our houses, as being attracted by lights they come into our houses by night, and, being night moths, seek to hide by day.

It is probable that the moths, after pairing, seek some grass spot on which to deposit eggs, for true it is that we find the caterpillars, in fall and spring, amidst the roots of grass, on which they appear to feed, though even these immature larvæ may, like the mature one, come forth for the more succulent blade and leaf. And among all insects there is a strange instinct which seldom errs, which secures egg-laying in close proximity to the food of the larvæ.



FIG. 3.—*Agrotis Cochranii*.—Larva and Imago.

The young cut-worms, perhaps from their small size and abundant food, seem to attract little attention because of their injuries till the succeeding May, when the full grown larvæ, now over an inch in length, greasy, and in sober garb of gray, brown, or striped with light and dark, depending on the species, come forth to nip our crops and blast our hopes.

After the larvæ growth is complete they become chrysalids in an earthen cocoon, a few inches from the surface, and in summer and autumn the moths again appear, when the same cycle of growth, changes, and destruction is again repeated.



FIG. 4.—Pupa.

I might describe here, as before, many predaceous and parasitic insects which help to hold these dread destroyers in check, but as they are unable, without aid, to wholly accomplish the good work, I will at once proceed to the more practical duty of detailing artificial means to preclude these injuries.

REMEDIES.—I am fully persuaded that there is no more sure way to ward off cut-worm injuries than to enter into partnership

with the birds, in which it shall be the duty of the party of the first part to plow the land early in the fall, so that blue-bird, robin, and grackle may have a cut-worm feast before leaving for more genial climes. Deep harrowing will aid the party of the second part, while a repetition of the same as early in the spring as the season will permit will insure a thanksgiving repast of the same nature. I feel very certain that from this cause, and not freezing of the larvæ, has originated the unquestionable fact that fall plowing is an advantage. When unprotected larvæ can survive a temperature of 30°, as I have proved the past winter, we may be slow to credit the freezing method of destruction.

Our early spring birds are much put to it to gain sufficient food for themselves and brood, and with the opportunity will become chief abettors in cut-worm destruction. That the three birds above named do merit loudest praise for such valuable service I have personal proof.

The only method to supplement the above measures when they are not adequate to remove the evil, with our field crops, is digging out by hand and destroying. This is by no means so tedious a procedure as would be thought at first, as by passing along the corn-field early in the morning the cut stalk will reveal the whereabouts of the night-marauder, which, by digging around the stub, may soon be found and crushed. As this plan implies the loss of at least a single stock to a larva, it would be very well in planting to practice the advice of the poet: "Two for the blackbird, two for the crow (they have earned them), two for the cut-worm, and four to grow." This advice will be all the more pertinent if the corn is to be planted after late spring-plowed greensward; I need hardly say late, as our wet springs usually necessitate late spring plowing.

If our farmers will heed the above, and give the go-by to all those quack remedies which obtain annually an unmerited place in our periodicals, such as salt, plaster, etc. (though all fertilizers which promote rapid growth are always to be commended as aids in the work of insect destruction), this cut-worm evil will soon assume less importance.

The following are the species which I have found injurious

to our corn crops in this State: *Agrotis nigricans*, Linn.; *Agrotis devastator*, Brace; *Agrotis subgothica* (see Fig. 2d), Haworth; and *Hadena amputatrix*, Fitch.

The May Beetle.—*Lucdnosterna fusca*, Frohl. Family, *Scarabaidæ*. Order, *Coleoptera*. Few farmers will need a description of that sleek old culprit, the white grub,—still less to be assured of its destructive powers, as the damage to our meadows and other products are becoming yearly more alarming.

NATURAL HISTORY.—I need hardly say that in May and June the beetles (3 and 4, Fig. 5), all brown and plump, come forth from the ground, and at early twilight, and on into the night. fly forth in such numbers as to sound like the swarming of bees, often annoying us by thumping at our windows or lumbering

into our rooms, to be felled by bumping the walls; hence the name dor-beetle. and the expressions “beetle-headed,” and “blind as a beetle.” These beetles often do no inconsiderable damage by eating the foliage from our fruit trees, though in some localities they have seemed to prefer the oak leaves. Would that they might rest content with the

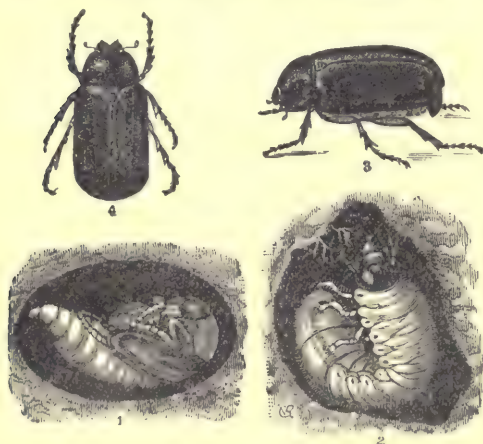


FIG. 5.—1, pupa; 2, larva; 3 and 4, Imagos.

completion of such mischief. After pairing, the females lay their eggs, fifty or more, probably in the ground, near the roots of grass or other plants.

The grub, white, wrinkled, with a brown head (2, Fig. 5), feeds on the roots of grass, wheat, corn, and other plants for three years, when it becomes full-grown, having attained nearly one and one-half inches in length. In the third autumn it forms a cocoon of earth, in which it pupates (1, Fig. 5). The next May or June the beetles come forth to enjoy a brief riot, and prepare for another round of mischief under ground.

REMEDIES.—As the number of these beetles and grubs are

frequently so alarmingly great, and their mischief so wide spread and extensive, we can only hope to ward off their ravages in our pastures and meadows by wholesale remedies. So soon as the meadow turns sear, and we have the further evidence that the white grub is the culprit in the grass, now rootless, freely yielding to the hand or rake; or, still better, finding the sleek old gormand beneath by a little digging—if this state of things is so extensive as to create uneasiness, the field better be given over at once to the swine, and the more swine the better. It may be as profitable to turn the grass into pork, indirectly through the aid of the white grub, as to change it directly into beef or mutton; besides, we then are sure to destroy a grievous pest. If a meadow is the seat of the evil, it may pay best to cut the hay first. Early fall plowing will enable the birds to aid the swine, and possibly kill the grubs by destroying their food. Frequent harrowing will give the birds a still better chance to indulge in this “feast of fat things.”

In protecting our wheat and corn, the same remedies would apply as those recommended to destroy the cut-worm.

As yet, we know no method to fight these pests of our meadows, except the one given above; and if the ravages appear while the grub is in the first or second year's operation, which can be ascertained by the size, the above method of procedure will be still more desirable.

These white grubs often do great damage to strawberry plantations. Strawberries should not be planted immediately after turning the sod, nor left to be matted down with grass. If planted on land which has been kept clean of weeds, etc., by hoeing, there will be little loss from these grubs.

The Wheat Midge.—*Cecidomyia tritici*, Kirb. Family, *Cecidomyiidae*. Order, *Diptera*. Like its near relative, the Hessian fly (*Cecidomyia destructor*), the midge, or wheat berry fly, is not yet driven from among us, though its many insect enemies have so depleted its numbers, that it no longer fills our agriculturists with forebodings as to the future of our wheat interests.

NATURAL HISTORY.—The natural history of the midge is as follows: The little orange fly, so small as to almost escape

notice, appears in June. The eggs are laid on the chaff of the berry. Upon hatching, the orange-colored maggot lies between the chaff and berry, and by absorbing the juices, ruins the kernel, and thus an insignificant larval fly does immense damage.

REMEDIES.—This important enemy, which does no great damage in Europe, because of the numerous parasites which prey upon it, is fast losing its terrors here, and so I will only mention the very commonly understood preventives.

If they are troublesome, get the variety of grain which is least affected and most vigorous, and then sow fall wheat so early, and spring wheat so late, that the former may mature too early to be injured; the latter, too late. By great pains in cultivation the fall wheat may be urged on so as to be free from danger.

Hessian Fly.—*Cecidomyia destructor*, Say. Family and order as above. This insect, doubtless owing to its numerous insect enemies, is very irregular in its injuries. It will seem to disappear entirely, and then all at once come forth in myriads, to bring ruin to the wheat fields. After a little it again seems to go away. It has not gone; only held in check by its many foes.

NATURAL HISTORY.—The little gray fly, looking almost exactly like a small mosquito (Fig. 6), lays its rows of eggs on the inside of the leaves, in number from one to five in each string. These are laid in September and May, as the insect is double brooded. As soon as hatched, the maggots (Fig. 6, *a*) work down between the leaf and the stalk, and by absorbing

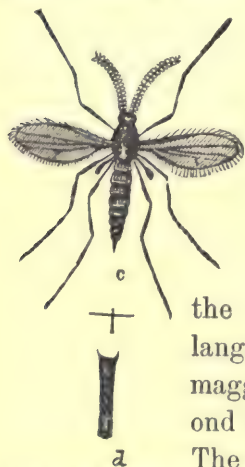


FIG. 6.—*a*, Maggot.
b, Pupa. *c*, Imago.

the juice, so weaken the plant that it languishes, and frequently dies. The maggot is white. The attack of the second brood causes the stalk to bend over.

The pupæ—the so-called flax-seed (Fig. 7)—look like brown seeds, and may often be found by pulling back the leaves, to the number of five or six, sometimes fairly imbedded in the stalk.



FIG. 7.

REMEDY.—Late sowing—after the 20th of September—is usually found very wise. Some prefer to sow early, and then, by excellent cultivation and thorough fertilization—sowing only the most vigorous varieties—they hope to so increase the vigor of the crop that it will not materially suffer.

Wire Worm.—*Elater*. Family, *Elateridæ*. Order, *Coleoptera*. Few insects are more dreaded in many parts of the country than are the wire worms. If we except beans, peas, and buckwheat, we can hardly mention a crop that they do not often seriously injure. They are only bad, however, on crops the second and third year after sod is plowed under.

NATURAL HISTORY.—Wire worms, the larvæ of elater (Fig. 8), or spring beetles, usually feed on rotten wood, so that we can hardly raise a piece of bark on a decaying log, or turn over a rotten log,



FIG. 8.

without finding them. Would that all were content with such a diet; but not so, for, as too many know by disheartening experience, some of them attack the newly planted potatoes in a perfectly ruinous manner, so that to have a crop demands a second planting. Nor do they behave better towards the fresh corn plants. These wire-worms are well named, as they much resemble in form both a worm and a wire. They have the six usual jointed legs, and thus may be easily told from the myriapods, which they somewhat resemble, but which have many legs. They work for several years and pupate in an earthen cocoon. The beetles (Fig. 9) which come from these grubs, are the well known elaters, or spring beetles, which possess such a power of springing up, if, perchance, they fall on their back. This habit, no less than their peculiar form, will serve to distinguish them wherever seen. I am not able to state what species are injurious when in the larvæ state.

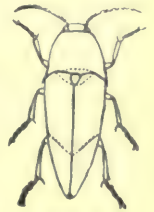


FIG. 9.

REMEDIES.—The same course as that recommended for cut-worms and the white grub—fall plowing and frequent harrowing, to give the fall and spring birds a good chance, will also serve here. In England, where they are greatly troubled with these same or similar insects, it is common to bury potatoes with a

long stick stuck through them to mark their whereabouts. This is done early—some time before planting. The grubs collect on these to feed, when they are gathered and destroyed. Gas-lime and salt are also highly recommended by experienced gardeners of Europe. These are placed with the seed in planting.

If the wire-worms seem very abundant and harmful, I would advise the sowing of buckwheat the second year after plowing under sod. The first year they seem to prefer the decaying grass roots, and buckwheat seems distasteful or poisonous to them. The same is but little less true of beans and peas.

Pea Weevil.—*Bruchus pisi*, Linn. Family, *Bruchidæ*. Order, *Coleoptera*. This little insect, though doing little damage to garden peas, for in green peas it is not only too small to essentially change the flavor, but even to attract the eye, but in field crops, where peas are raised to feed after they are fully matured, there is very serious injury, for this little weevil, so generally distributed, and so persistent in its yearly attacks, consumes, while yet a larva, all the nutritious material of the pea; leaving only the germ and a mere shell outside. Hence, affected peas will sometimes (though only rarely) grow, but, of course, with bated vigor, as the needed starch pabulum is wanting in those early days, the precarious time with all life; but to feed, they are almost entirely useless.

NATURAL HISTORY.—The little brown weevil, with the wing-covers so short that some light markings, somewhat resembling

the letter T, are seen just back of them (Fig. 10.—*Bruchus pisi*, Linn.), comes through the winter in the peas, having a little opening (Fig. 10, *b*), a door of exit, already prepared, where they not infrequently remain even to the day of sowing. I have seen them thick as

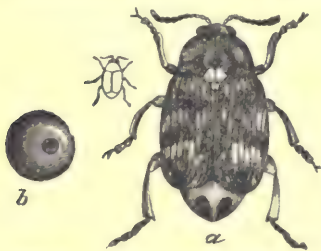


FIG. 10.—*a*, Imago magnified. *b*,
Pea. *c*, Natural size.

bees above the ground where peas were being sowed. Just as soon as the pods are formed and the seeds set within them, the weevil, big with eggs, if not with mischievous intent, pierces the pod opposite each pea, and inserts an egg within each puncture, so that every pea may contain

within the seed of its own destruction. The larvæ, which soon hatch from these eggs, though grubs, being the young of beetles, are legless, and hence resemble maggots—the larvæ of two-winged flies, which name is frequently applied to them. These larvæ find the young tender peas rich feeding, and by the time the peas are large enough for table use, are sleek and plump, and can easily be seen with the naked eye; and with a glass, their good feeding qualities are quickly discerned, as their tender skins seem ready to burst. By the time the peas are hard, having already eaten a hole through the shell (Fig. 10, *b*), thus showing a foresight not rare among insects, they assume the pupa state, and change to imagos before the time for sowing or planting the next spring.

REMEDIES.—As these insects are in the peas in the winter and in the spring, if the same be kept over one year, in perfectly close barrels, bags, cans, or bottles, of course the insects thus confined will all die. Hence, if these pea weevils are sufficiently annoying to cause disturbance, there can be a most effectual estoppel put upon their mischief by thus putting all our peas in close vessels, any time in the winter, and keeping them thus close for one season. If all would do this—and we must have concerted action in this insect warfare—we should soon be rid of this enemy. But the evil will be mitigated if we practice the above simply as individuals; for if the insects do find their way to our fields from those of our careless neighbors, they will doubtless come in far less numbers, and those that do come will very likely be too late to do damage, while we *may* escape entirely. If the peas be put into boiling water early in spring, or if a little bi-sulphide of carbon be put into a close box with the peas, and the box quickly closed, the weevils will be destroyed. As bi-sulphide of carbon is very explosive if the vapor comes in contact with a flame, caution is required. Its pungent odor tells so quickly, however, of its presence, and it is so rapidly dispersed with ventilation, that carelessness alone can be credited with any accident that may occur.

Bean Weevil.—*Bruchus*, Fabæ. This insect attacks the bean, just as the above attacks the pea, only several instead of

one are often found in a single bean. What has been said above as to remedies also applies here.

The Squash Bug.—*Coreus tristis*, De Geer. Family, *Coreidae*. Order, *Hemiptera*. This old-time enemy is so well-known that the figure is all that is necessary to bring his image and evil doings to mind.

NATURAL HISTORY.—The squash bug, in common with all bugs, passes through partial or incomplete transformations, by which we mean that they are quite alike at all stages of growth, so that usually, at any stage of growth, the species would be recognized by even the unskilled in entomology. The larva, unlike the caterpillar, the grub, and the maggot, is so like the imago that the relation of child and parent is easily recognized. The ma-



FIG. 11.—Imago.

ture insect (Fig. 11) hibernates during winter, but by the time the melon, squash, or pumpkin vines are well up, their dusky forms, ocher yellow beneath, may be seen feeding on the leaves by day, and hid under some chip, clod, or in some crevice by night. Soon the brown eggs are laid in clusters glued to the under side of the leaves, and the greenish larvæ, which soon become grayish, which hatch from these, commence a thorough work of despoliation, in which they are aided by their parents, which seem unwilling to die with so much good provision at hand. After a time, stubs of wings appear, which, with increased growth, is all that serves to distinguish these pupæ from their former larval condition. Nor can these afford time for quiet, like most pupæ. On the other hand, they continue to gorge themselves with the juices which they suck from the plant. Soon they attain full growth, and fully developed wings, and are called imagos. These imagos live through the winter, and are ready to repeat the same ruinous work another season.

REMEDIES.—The habit that these squash bugs have of concealment suggests a very practical means to capture them, which was tried here at the college the past season with perfect success. It is similar to the Ransom process for capturing the plum curculio, and consists simply in placing small pieces, boards, chips,

or even green leaves, on the ground, close around the vines. The bugs appropriate these as hiding places during the night. We may then go around each morning, early in the season, before the eggs are laid, and gather and destroy the bugs thus concealed, and soon extirpate the cause of the evil. These morning visits must be so early that the insects will not have yet left their hiding places. If the eggs are laid before we capture the bugs, we should either gather the eggs from beneath the leaves, or continue the same process narrated above to get rid of the young.

In all cases where mature insects come forth in the spring, of course in limited numbers, as with the potato beetle, the squash bug, etc., we shall save very much by early battle; and if we can persuade our neighbors to engage with us, the late battles and the battles of succeeding years will be but skirmishes.

The past summer I have killed several bugs by use of kerosene oil. Bugs do not eat, but insert their beaks, and sip the juices of the plants. So we can not poison them by use of the arsenites, etc. Neither do they care for pyrethrum. Here, then, we may be glad of kerosene. To apply this, dilute with sour milk—one of oil to five of milk—stir thoroughly, and apply with fountain pump. This may also be used successfully in killing the striped bug—*Capsus quadarivittatus*, Harr—which often does great harm to potatoes, wheat, corn, and others of our farm and garden plants. This beautiful little bug is yellow, with four black bands, and is about three-eighths of an inch long.

The tarnished plant bug—*Lygus lineolaris*, Beauv.—which is very commonly distributed through the country, is also indiscriminate as a feeder. This is the bug that destroyed thousands of dollars' worth of strawberries in Southern Illinois the past season, sucking the juice and vitality from the unripe fruit. It is probable that kerosene and milk will fix them. Care is requisite that the mixture be not too strong, or the plants may be killed.

Professor Forbes has found kerosene an excellent specific against the terrible chinch-bug of Illinois and the West. Aside

from destroying rubbish, etc., that the imago may have no suitable place to hibernate, this is about the only known cure for this terrible pest.

Squash Vine Root Borer.—*Melittia cucurbitæ*, Harr. Family, *Ægereidæ*. Order, *Lepidoptera*. This insect, a near relative of the peach-tree borer and currant borer, is no new enemy, having worked in Massachusetts and other States East for many years.

NATURAL HISTORY.—The moth, which is a beautiful orange, with deep blue wings, in common with all of this family, flies during the hottest swift-ness. She and August, on The larva, which

sunshine, and with great lays her eggs during July the vine, close to the ground. would be known as a cater-

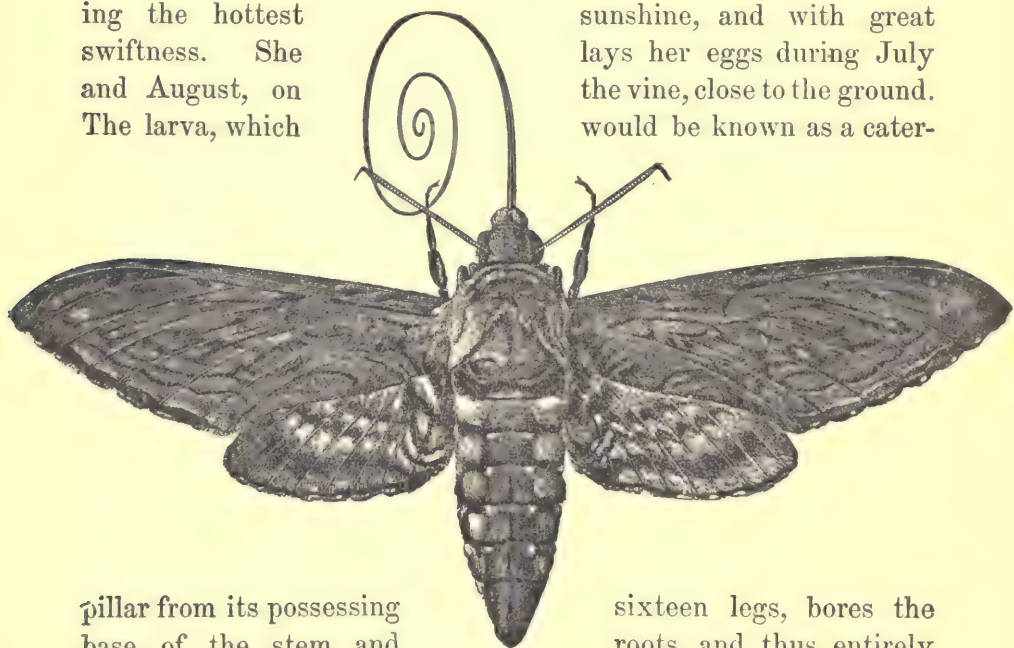


FIG. 12.

pillar from its possessing base of the stem and destroys the vines.

sixteen legs, bores the roots, and thus entirely They pupate in a rough cocoon of earth, about the roots. Dr. Packard has noticed their forming their cocoon in the stem. These are formed in autumn. The imago comes forth the next summer to inaugurate the same round of ruin.

REMEDIES.—To dig out the borers so soon as discovered is a sure but tedious method, and the vines are often ruined before the presence of the larva is discovered. It is asserted that covering the stem and insect with earth prevents further dam-

age. It would be well to try this. It has been recommended to catch the moths; also to carefully gather the eggs. But I much doubt the practicability of these methods, especially the latter. It is possible, and certainly very desirable, that we might discover some preparation with which to surround the vine, that would be so obnoxious to the moth as to prevent egg-laying. Limited trials of gas-line, whale-oil soap, weak solution of carbolic acid, and other insecticides might be made. It would be very well to try the remedy given by Secretary Bateham, of Ohio, to prevent the work of the peach borer, which is given in the description of that pest.

Tomato Worm.—*Macrosila quinquemaculata*, Haw. All who grow that beautiful and savory vegetable, the tomato, are acquainted with the formidable pest which, unless prevented, too often brings all our hopes of satisfied tomato appetites to naught. Who has not seen the beautiful larva, so fat and gay in its robes of deepest green, trimmed with yellow or white and beaded with the same, and who has not heard of the utterly groundless stories of its fatal horn, whose poisonous thrust it is said brings pain and death.

NATURAL HISTORY.—In July, the beautiful large gray moths (Fig. 12) appear, lay their eggs on the leaves of the tomato, not refusing potato vines in the absence of tomato plants, which they evidently prefer, at which

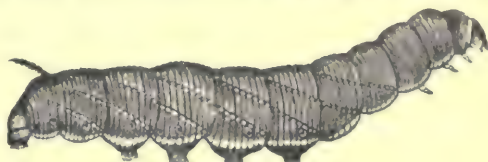


FIG. 13.

work they may be seen early in the evening. I have frequently caught these so-called humming-bird moths around the tomato plants, or poised above flowers, where, with their long sucking-tube, they seem engaged in extracting nectar. The greenish larvæ (Fig. 13),

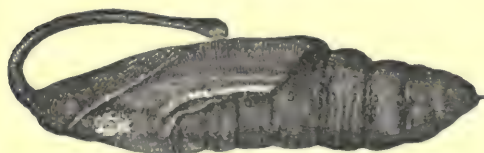


FIG. 14.

though they are not infrequently dark brown, eat voraciously, grow rapidly, and by the last of August they have not only

stripped the plants of their foliage, but have become full grown, when they measure three inches in length. They then go into the earth, where they pupate in an earthen cocoon. The peculiar form of the pupa is a marked character of this family (Fig 14). These brown pupæ may be found in the earth, a few inches beneath the surface, until the following summer, when the fine moth again comes forth.

REMEDIES.—Hand-picking is a quick, easy, and sure preventive. The only objection to this, so far as I know, is that it is disagreeable, and sometimes prevented by timidity. Yet I presume that a good pair of gloves will insure the temerity necessary to its successful practice. As before intimated, the fear is entirely groundless, for there are no more harmless creatures in existence. To be sure they can give quite a sharp pinch with their strong jaws, which they will attempt to do if held, and which I have often experienced while handling them, but this is almost painless and entirely harmless. They never use their caudal horn, the supposed weapon of immemorial dread. So hand-picking, with or without gloves, is entirely safe, and as effectual as safe. Of course, the disfigured leaves will guide us in our search.

I have found that skunks are powerful aids in this fight, as they feed extensively on the pupæ.

Cabbage Cut-Worms.—*Agrotis devastator*, Harr. As a full account of the natural history of the Agrotians has already been given in connection with field crops (see page 322), we need say but little of the species which is often so ruinous to our cabbage and tomato plants.

As will be remembered, the larvæ generally lie concealed by day just beneath the soil, and come forth, cloaked in darkness, to do their evil work. This is not strictly true, as frequently, on cloudy days, their eager appetites, or else an innate longing for destruction (for these cut-worms do seem the most totally depraved of all insects), impel them forth to work havoc. I have known sixty tomato plants cut off between the hours of 3 and 6 P. M.

Sandy gardens, and those near meadows, pastures, or lawns,

where the insects have commenced and nearly completed their growth by feeding on the grass or its roots, are by far the most liable to attack.

REMEDIES.—After the ground is well fitted for the plants, great advantage will result from placing newly mown grass, fresh cornstalks, etc., in heaps about the plat. Coming to these by night, the larvæ will feed and crawl beneath, and may be captured and destroyed each morning. I have known large numbers to be thus entrapped. Securing those immediately within the ground to be planted, however, is not alone sufficient. These larvæ have not sixteen legs for nothing, and especially is there danger from immigrants if grass is grown contiguous to the ground planted. It might be well to continue, in such a case, to place the bunches of grass around the border of the planted area, to still attract these night marauders.

Sized paper, such as we usually write on, wound closely about the plants, and held in place by banking slightly about the base with earth, is a sure preventive, as the larvæ can not pass up its smooth surface. I have known this to be practiced with the happiest results. Care is only necessary that the paper may closely encircle the plant, and that the banking be so efficient as to surely hold it in place.

Hand-work, digging out the larvæ, is always to be commended. No more injury need be expected from these troublesome “worms,” if they are once in the grasp of an irate gardener, who is disgusted at seeing his plants prostrate upon the earth. And it must give rare satisfaction to dig the culprits out from beneath the plants which their rapacity has simply cut asunder and left to wilt, and aggravate the owner who had already reckoned up and planned to expend the proceeds from the same mutilated plants.

Here, too, especially on light soils, it will be wise to set a superfluous number of plants.

Cabbage Leaf-Roller.—*Plutella cruciferarum*. Family, *Tortricidæ*. Order, *Lepidoptera*. While treating of cabbage insects, I might describe the cabbage leaf-roller, or Cabbage tineid (*Plutella cruciferarum*), which little green “worms,” or more

properly caterpillars, mine the cabbage leaves quite disastrously, and which gray moths, with a white stripe along the back, are quite too small to produce alarm, and yet are the parents of the same green larvæ. But I will only say that I have never been troubled with them, nor have I seen much of their work. If they are annoying, it would be well to try plaster with a little turpentine mixed in, whale-oil soap solution, or lime; nor should I fear to experiment with a little powdered white hellebore. All of the leaf-rollers, several of which are quite destructive to the apple foliage, are quickly destroyed by use of the arsenites; but it is unsafe to use these on the cabbages. Pyrethrum, which, as we shall show, is a most satisfactory specific against the cabbage caterpillar, would doubtless also destroy the insect just described.

Striped Flea-Beetle.—*Haltica striolata*, Fabr. Family, *Chrysomelidæ*. Order, *Coleoptera*. There is a flea-beetle, too (*Haltica striolata*, Fabr.), which I have found to puncture the leaves of cabbages, and is thus quite destructive to young plants. It also works on radishes, turnips, etc.

NATURAL HISTORY.—This beetle is of a shining black color, with two waving lines of buff along the back, one on each side, is very small, less than one-tenth of an inch in length, but is so active, briskly leaping away at the least disturbance, that, though so small, it can hardly escape notice. (Fig. 15.) These beetles often fairly swarm on young plants, and at such times do considerable damage.



FIG. 15

REMEDIES.—In England, where a nearly related beetle has long given annoyance by attacking cruciferous plants, lime, soot, and even ashes, are recommended as securing the plants against the ravages of these pests. I have tried these remedies, but without perfect success. Still I think they are to be recommended. Quick lime will do even more to protect the plants. Any thing which promotes vigor of growth is, of course, desirable, for vigorous plants are far less liable to suffer destruction.

By sweeping a fine gauze net over the plants, large numbers of the insects may be caught and destroyed.

The grape flea-beetle (*Haltica chalybea*), a small, steel-blue

beetle is closely related to the above in style and habits, though not in color. Eats the buds from the grapes in early spring, and the grubs destroy the foliage later. I have found that the arsenites and kerosene used as already described are both entirely satisfactory in destroying this enemy of the grape.

Other Cabbage Moths.—I might speak of the larvæ of various moths which feed on the leaves of the cabbage; but for lack of space I will only say that pyrethrum will destroy all or nearly all. Should it fail, kerosene or hand picking should be tried.

Cabbage Fly.—So, too, I might discuss the cabbage maggot (*Anthomyia brassicæ*, Bouche); but this, as also the onion maggot (*Anthomyia ceparum*, see Fig. 16), both of which are in our State, are so similar to the radish fly and maggot (*Anthomyia raphani*) that what I shall say as to the natural history and habits of that species will apply to both of the others.

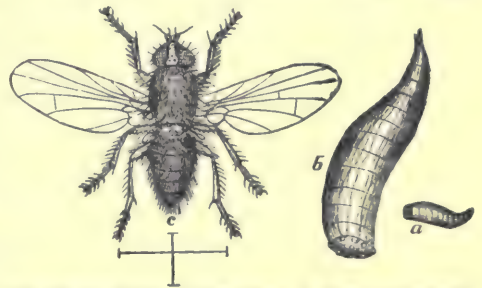


FIG. 16.—a. larva, natural size. b. Same magnified. c. Imago. The lines beneath show the natural size.

Aside from the carbolic acid remedy recommended in fighting the radish maggot, I have found bisulphide of carbon a certain destroyer of the cabbage maggot, which has done serious damage in this vicinity. By use of a cane I made a hole in the earth close beside the cabbage two or three inches deep, in which I turned a half teaspoonful of the explosive, and quickly filled the hole with earth, which was firmly pressed down by stepping on it. The vapor spreads and kills the maggots at once.



FIG. 17.

Rape Butterfly.—*Pieris rapæ*, Schrank. Family, *Papilionidæ*. Order, *Lepidoptera*. This insect, so recently imported, is now widely extended in our country, and a most serious pest.

DESCRIPTION.—This butterfly is white, spotted with black,

resembling very much our old speckled white cabbage butterfly (*Pieris protodice*, Boisd.), though, as will be seen by the figures (Fig. 17, male, Fig. 18, female), the spots are better defined, while usually there is less black.

This larva (Fig. 19, *a*) is pale green, finely dotted with black, and when mature, one and one-half inches in length, while the larva of our old spotted butterfly is blue, striped with yellow.

The chrysalis (Fig. 19, *b*), which fastens under a board or clod, attaches at one end, and fastens a silken band around near the other extremity. It is brown, while the old one is gray. I am thus particular in this description, as it is imperative, that we may know the enemy at the first onset, so as to give quick battle.



FIG. 18.

NATURAL HISTORY.—These butterflies, like both species of our common white ones, are two-brooded. The first butterflies appear early in spring, in April or May. After pairing, the eggs are deposited on the under side of the cabbage leaves. These hatch, and the larvæ feed on the leaves, assume the chrysalis state, and the imagoes come forth again in June or July. The second brood behave similarly, except that they remain as pupa or chrysalids through the winter.

FIG. 19.—*a*. Larva.
b. Chrysalis.

REMEDIES.—As pyrethrum is so fatal to these pests and so entirely non-poisonous to higher animals, it alone is all the remedy needed. Mixed one to twenty with flour, or one tablespoonful to two gallons of water—the first to be blown on by use of a hand bellows, the latter forced on by use of a fountain pump—I have found it quick death to these pests of the cabbage grower. This pyrethrum, which is the powdered flowers of a composite plant, *Pyrethrum cinerariæfolium*, is now extensively grown in California, and sold at reasonable prices. We find it admirable to kill house flies. We darken the rest of the

house, and make the kitchen light. After getting the kitchen as full of flies as possible, we blow a little of the pyrethrum into the room, and in an hour have the pleasure of sweeping up the flies and burning them in the stove. They all fall in a stupor to the floor. Unless burned a few may recover. To breathe or even to eat it is entirely harmless to man and the higher animals. I have also used, the past season, kerosene to kill these insects. It can be mixed with sour milk or with soft soap, as before described.

The evil from the cabbage butterfly is likely to be greatly mitigated among us by a parasite, which also pupates in the pupa skin of the butterfly. No pupa containing these should be destroyed. Such chrysalids may be known by their darker color.

The Radish Fly.—*Anthomyia raphani*, Haw. Family, *Muscidæ*. Order, *Diptera*.

NATURAL HISTORY.—The small, ash-colored flies, very like the onion fly (Fig. 16), doubtless hibernate, though some may pass the winter as pupæ. However this may be, the flies are around early in the spring, for our earliest radishes are the ones most liable to suffer from attacks. The eggs are laid on the stem close to the ground. These soon hatch, and the whitish, footless, conical larvæ, very like the onion maggot (Fig. 16), feed on the roots, forming grooves all over its surface, which induces decay, and renders the roots unfit for use. In June they transform to pupæ and to imagos, and are ready to make a new deposit of eggs. Hence we see why our early radishes are so very liable to attack, while later ones are often free from injury, though some years none seem to escape. Whether there are more than two broods a year, and whether they attack other plants than radishes, are, so far as I know, still open questions.

REMEDIES.—The late Dr. Walsh recommended hot water as fatal to these maggots and harmless to the plants. I have tried this with some, though not satisfactory success. I have succeeded better by use of a carbolic acid mixture—the same that I would recommend to repel the peach borer moth and the squash borer moth. I mix one quart of soft soap and one gallon of water. Heat till the mixture boils, and then add one pint of

crude carbolic acid. This may be diluted with from twenty to fifty parts of water, and either sprinkled on to the young radishes or turned into a trench made close beside the row. This preparation is also good to use about stables to keep the flies away, and in poultry houses to destroy lice and mites. For these last I have replaced the carbolic acid with kerosene. It is easier, however, to mix kerosene with sour milk.

Blister Beetles.—*Lytta cinerea*, Fabr., and *Lytta atrata*, Fabr. Family, *Meloidæ*. Order, *Coleoptera*. These

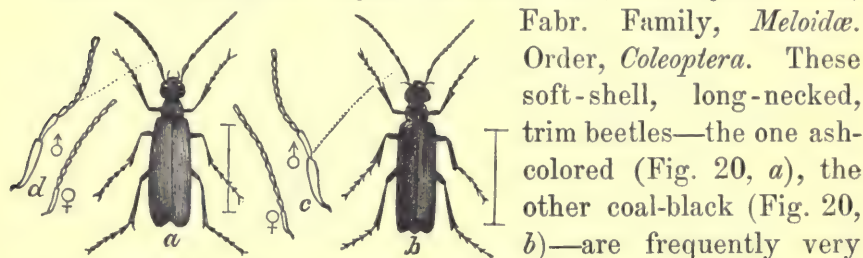


FIG. 20.—c. Male and female antennæ of b. d. Same of a. These soft-shell, long-necked, trim beetles—the one ash-colored (Fig. 20, a), the other coal-black (Fig. 20, b)—are frequently very injurious to various vegetables and flowers. They sometimes attack beans and asters, and make quick work of whatever falls a prey to their voracious habits.

NATURAL HISTORY.—The larval condition of these beetles has been unknown or involved in doubt. It is now known that allied species have a very strange and intricate metamorphosis, and are parasite on bees.

The beetles appear in early summer and in autumn, and are very voracious feeders.

REMEDIES.—These beetles have the habit of falling off of the plants whenever the latter are suddenly jarred. So in case the plants are tall enough to receive a sheet beneath, or can be bent over an umbrella, the beetles may be readily gathered, and then destroyed by scalding or crushing.

A striped blister beetle (*Lytta vittata*) is often called the old potato beetle, from its attacks on the potato. All of these beetles can be killed by use of Paris green or London purple.

The Striped Cucumber Beetle.—*Diabrotica vittata*, Fabr. Family, *Chrysomelidæ*. Order, *Coleoptera*. This beautiful little beetle, yellow with black stripes (Fig. 21), which seems suddenly to fairly swarm



FIG. 21

on the cucumber and melon vines, is often the cause of great vexation to the gardener.

NATURAL HISTORY.—The larvæ (1, Fig. 22) feed on the roots and underground stems, mature in about a month, pupate in the ground, in which state they continue about two weeks, when the imagos appear. There are two broods a year, and may be three. It passes the winter in the pupa state. The first imagos of the season attack the young vines, and in a single day may destroy them utterly. The later insects do not do so much damage, as the vines, from increased growth, are able to stand the attack.

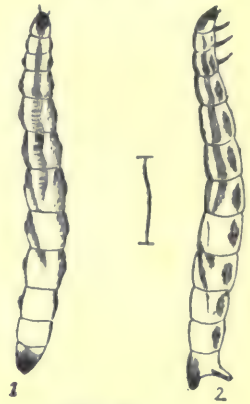


FIG. 22.

REMEDIES.—Boxes covered with glass or millinet and placed over the vines are sure protection, providing the beetles do not get inside. If glass is used, care must be taken to shade from the hot sunshine, or the plants may be ruined. These will form miniature hot-beds, and will hasten growth if rightly managed.

Paris green is a certain preventive, and in careful hands is harmless to the vines. I have used this remedy with the very best success. I would put one part green to eight parts flour, apply when the vines are dry, and add just as little as I could and see it on the vines. Add a little too much, and the vines are sure to be killed. The past summer I found that the kerosene and milk, one to ten, worked well in combating these insects.

The Codling Moth.—*Carpocapsa pomonella*, Linn. Family, *Tortricidæ*. Order, *Lepidoptera*.—All will concede that this insect holds first rank among our insect pests.

NATURAL HISTORY.—The little gray moths (Fig. 23, *f* and *g*), come forth in May and June, are wholly nocturnal, and therefore seldom seen. As soon as the fruit forms, a single egg is laid on the blossom end of the fruit (Fig. 23, *b*), and as soon as the egg hatches, the larva (Fig. 23, *c*) enters the apple. All know the subsequent history of the larva in the fruit, for who has

not seen the tiny white caterpillar, with its black head, mining away at the rich pulp, which it replaces with filth? In three

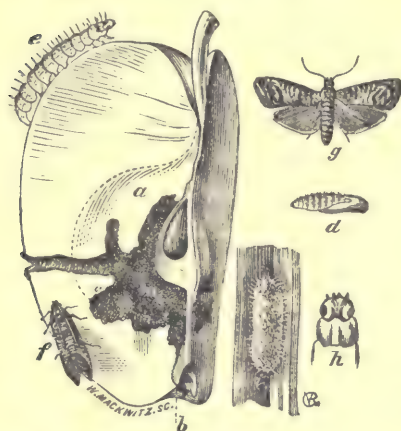


FIG. 23—*a*, Work in Apple. *b*, Place of Entrance. *d*, Pupa. *e*, Larva. *f* and *g*, Imagos. *h*, Head of Larva. *i*, Cocoon.

weeks the larva matures, leaves the apple, and in some concealed place spins a silken cocoon (Fig. 23, *i*) and assumes the chrysalis state (Fig. 23, *d*). In from nine to fifteen days, varying with the temperature, the moth issues. The apples are again stocked with eggs as before, after which comes a recurrence of all the disgusting work narrated above, except that the larvæ, upon leaving the apple, simply spin cocoons, in which they re-

main till spring, when they pupate, and in about two weeks the first moths appear.

The time when the first moths come forth varies from May 1st till July 1st; so that moths will be issuing from May 1st till August 1st, and the "worms" will be leaving the apples from the last of June till the fruit is gathered. My own experience seems to show that no pupæ are formed after the last week of August, as, so far as I have examined, all larvæ that leave the apple after that time simply spin a cocoon, in which they remain as larvæ till the next spring. Some of the observing fruit men of our State think that during the past season many of these insects pupated after that time. Such cases come not within my observation.

Of those larvæ which leave the apple while it still hangs in the tree, about one-half crawl down, till beneath some bark or in some crevice they find seclusion in which to spin unobserved. Those which fall to the ground with the fruit crawl out, and if the ground is free from all rubbish, stumps, etc., they crawl up the tree and hide as before.

REMEDIES.—The old method of placing bands around the tree was not satisfactory, so many would not practice it, and so

many who did put the bands in place, neglected to examine them and kill the worms, that this plan justly lost favor. A better method is to turn hogs and sheep into the orchard. They will eat the major half of the affected fruit. By discreet thinning, using a forked stick, we can give the hogs nearly *all* the wormy fruit, and the increased size of the remaining fruit will pay for the thinning. The best way is to sprinkle

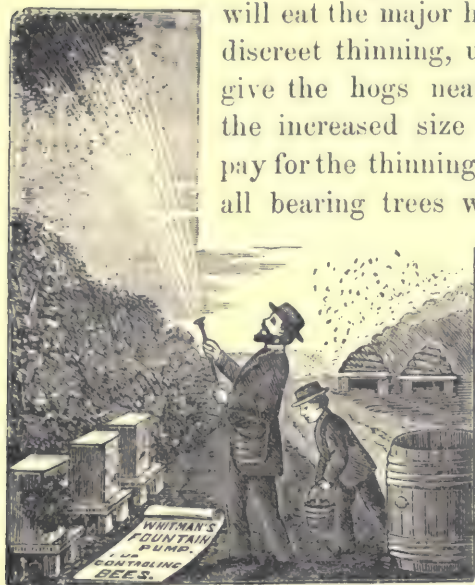


FIG. 24.—Whitman's Fountain Pump.

after the trees bloom, and then two and four weeks later. Enough poison lodges on the apples to kill the worms; but it is all washed off long before the fruit is fit to use. Three years' trial proves this remedy *most excellent*. I use one pound of London purple to one hundred gallons of water; draw it through the orchard in an open barrel with a float to prevent slopping, and distribute by means of Whitman's Fountain Pump. The practice of this method makes it less necessary to place close wire screens over the cellar windows in May, June, and July. Fires, or bottles of sweetened water, or vessels of sour milk, so often recommended to destroy these insects, will do no good whatever.

Old Apple-tree Borer.—*Saperda candida*, Fab. Family *Cerambycidae*. Order, *Coleoptera*.—This pest, which has been so long in our country, is widely distributed in our State. Very few, if any, orchards are exempt from its attacks. Not that it always, or generally, totally destroys the trees; still, those suffering from its attacks are always lessened in vitality, and it not unfrequently happens that the trunks become so riddled with their tunnels that the tree becomes a prey to the hard winds, which are sure to come with each returning year.

NATURAL HISTORY.—The beautiful brown beetle (Fig. 25, *c*), with its two stripes of white, appears early in June, and thence on through July. So the egg-laying is principally done in these two

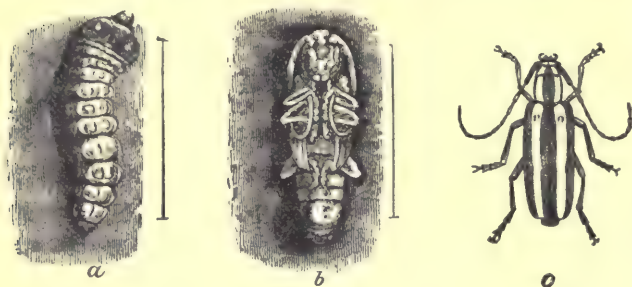


FIG. 25.

months. The grub (Fig. 25, *a*) whitish, with a round black head, eats through the bark, and then usually passes in and up, frequently

eating through the branches far out toward the extremity. I have frequently found apple-tree limbs no larger than my thumbs, with a tunnel as large as a pipe-stem. These larvæ push their saw-dust like particles back of them and out of the hole where they first entered, so that it is not difficult to find them. They live and feed on the wood of the tree for three years; hence, we see how that a single larva may bore, if left undisturbed, for a distance of several feet. They finally bore a hole for exit, fill it slightly with their sawdust, and a little back of the same make a cocoon of their own chips, in which they pupate (Fig. 25, *b*). Soon after, in June and July, the beetles again appear.

REMEDIES.—Soapy mixtures are found to be obnoxious to these beetles, so that in their egg-laying they are found to avoid trees to which such an application has been made. Thus we may hope to escape all danger by washing the smooth trunks of our trees early in June, and again early in July, with soft soap or a very strong solution of the same. T. T. Lyon, now of South Haven, whose judgment is very reliable in such matters, urges that we always use the soap itself. I have found the carbolic acid mixture, recommended for the radish maggot, undiluted even better than clear soft soap. Its obnoxious principle is more lasting. We should always examine the trees carefully in September, and wherever we find this pernicious grub's saw-dust shingle out, we should give him a call. Perhaps we may reach

him with a wire thrust into the hole, and by a vigorous ramming crush the culprits. If we have doubt as to the crushing, we should follow him with a knife; but in cutting out the borers too great care can not be taken to wound the tree just as little as possible. This heroic method is sure, and requires very little time, and no person who takes pride in his orchard, or looks to it as a source of profit, can afford to neglect this September examination, nor the previous application of soap, to which it is supplementary.

The Flat-Headed Borer.—*Chrysobothris femorata*, Fab. Family, *Buprestidæ*. Order, *Coleoptera*. At present this borer is quite as ruinous as the preceding one, and I should not think it strange if in a well balanced account it was found even to surpass the other in the evil which it works to our fruit interests. I have seen young orchards nearly ruined the first summer after setting, by this devastator. Not long since a nurseryman came from a distant part of the State to consult me as to the ravages of this pest. He said that during the past summer, in some regions of the State, more than half the trees he sold were killed by this scourge, and of course he was unjustly blamed. At present, no nurseryman should sell trees without throwing in advice in regard to protecting against this devastator; for, as we shall see, such trees are peculiarly liable to attack.

These borers are not confined to the apple-trees, as I have found them working in oak, maple, and other trees of our forests.

NATURAL HISTORY.—This brownish beetle (Fig. 26), with a coppery luster, is found from May till August, though I have found them more common in June and July. As with the striped *Superda*, the eggs are laid on the bark. The whitish grubs (Fig. 27), with their enormous front, brown head, and curled tail, usually bore only superficially, eating the inner bark and sapwood; yet I have seen, and have now on exhibition here at the college, sections of young trees over an inch in diameter, bored completely through by these big-headed rascals. They eat but a single



FIG. 26.

season, pupate as in the preceding case, and come forth as imagoes early in the spring.

They usually work on the trunk, though sometimes in the branches, almost always on the south, the west, or the south-west sides of the tree; and their whereabouts may always be ascertained, not only by the saw-dust, but also, and more certainly, by the black color of the bark. When the black color offers the suggestion of the presence of this borer, we can quickly become assured by striking a knife into the same. If the blade pierces the bark and goes on still a little further, we may be sure of the enemy's presence.



FIG. 27.

This borer is far more liable to attack feeble trees. Any thing, therefore, which serves to diminish the vitality of the trees promotes the ravages of this borer. Hence, after such a winter as we have just experienced, or after having the growth of our trees interrupted by the removal from the nursery to our orchards, we are in special danger of harm from these destructive borers. Hence, the coming season, when loss will be inevitable, we should more than ever be on the alert to mitigate the damage by our vigilance and care, and by the timely application of

REMEDIES.—The remedies for the flat-headed borer are the same as those given for the old borer—though these grubs may be found in July and August, and to delay the cutting out till September would often be fatal, especially to trees in newly set orchards. I have known cases where labor of this kind in July would have paid more than \$100 a day, besides saving a great amount of vexation.

Apple-Tree Bark Louse.—*Mytilaspis conchiformis*, Gmelin. Family, *Coccidæ*. Order, *Hemiptera*. This old enemy, though less destructive than formerly (probably because of parasites and mites which prey upon it, so that, like the Hessian fly, wheat midge, and many other insects, it has probably done its worst work), yet, to leave it to itself at the present time would be to yield the strife prematurely.

NATURAL HISTORY.—The bark-colored, oblong scales (Fig. 28), so harmless in appearance, serve from August to May only for

protection to the 60 or 70 wee white eggs (1, Fig. 29) which are found underneath. About the first of June the young lice (2, Fig. 29) appear,—so small that, though clad in yellow, they

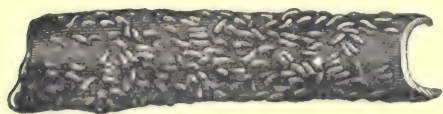


FIG. 28.

can hardly be seen without a glass. Coming forth from under the scale, they roam about for a few days,—are sometimes blown to other trees, thus spreading their evil work,—but very soon settle down to earnest business. This consists in inserting their tiny beak and sucking the vitality from the trees. Very soon a scale (3, 4, 5, and 6, Fig. 29, different stages of development of scale) commences to form around them, from an exudation which is a secretion from the general surface. By August the impervious scale is complete (7, Fig. 29). The eggs are then soon deposited, and the parent louse dries up and shrinks away to nothingness.

REMEDIES.—As the scale is impervious to most fluids, though oils will penetrate it and destroy the eggs, the best

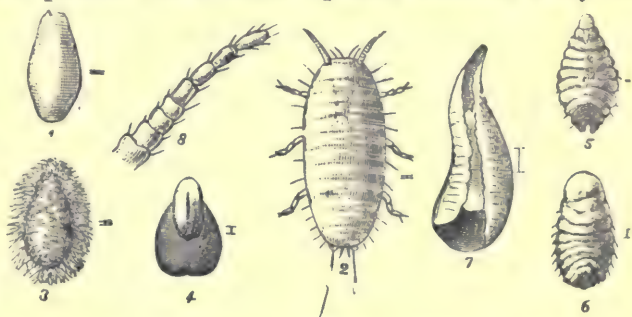


FIG. 29.

time to fight these insects is just after the eggs hatch. Hence, the same remedy recommended for the borers just described will prove effective here. The time of application is the same. Here then, three “birds are killed with one stone.”

Twig Borers.—There are two species of beetles which bore into the twigs of the apple tree and cause them to wither, one as a larva, the other when mature. Space will only permit me to state that to fight these we have but to cut off and burn the blighted twigs.

Canker Worm.—*Anisopteryx vernata*, Peck. Family *Phaenidae*. Order, *Lepidoptera*. This insect is widely prevalent in the United States, and once in an orchard, must be destroyed or the orchard will be.

NATURAL HISTORY.—The wingless female moth (Fig. 30, *b*), and the trim male (Fig. 30, *a*), with his ample wings, both gray or ash color, the female being a little the darker, come forth from the ground early in the spring:—I have often seen the males during warm winter days. The fe-



FIG. 30.

male crawls up the trunks of the apple trees, and after meeting the male, lays her cluster of eggs (Fig. 31, *b*), often to the number of one hundred. If the female fails for any reason to gain access to the tree, she fastens these egg clusters to any convenient object. I have often seen them in Cambridge, Massachusetts, fastened to the pickets or boards of fences. After egg-laying these insects soon die. Just as the leaves begin to burst forth, the larvæ (Fig. 31, *a*) begin to come forth. The larvæ (Fig. 31, *a*) vary very much in color. At first they are very dark, with faint, yellowish stripes. When full-grown they are striped with ash color, black, and yellow, and are about one inch in length. These larvæ belong to the loopers, or measuring worms, both names referring to their peculiar method of locomotion. They do not have the usual number of legs for caterpillars (16), but must be content with only ten. Hence their looping gait. They are also called drop worms, because of the habit of swinging from the tree by a thread when disturbed, or when they desire to go to the ground to pupate. As they are often seen thus suspended, it has been supposed that they frequently swing just for the pleasure of the thing. It may be that some disturbing wind or bird induced this strange maneuver.

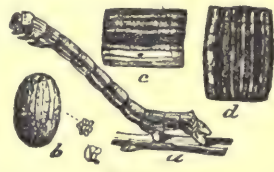


FIG. 31.

About the middle of June the larvæ are full fed, the tree fully denuded of its foliage, and that, too, at the worst possible time, the growing season, when the "worms" make for the ground, some creeping down the trunk, others dropping down by a silken thread spun for the purpose. Upon reaching the ground they burrow to the depth of four or five inches, and in an earthen cocoon change to pupæ. The chrysalis is of a light brown color.

This destructive insect is not content to injure the apple tree alone, but is equally ready to attack the elm, and not infrequently attacks cherry, plum, and other fruit and forest trees.

REMEDIES.—The many old-time remedies must all sink before the use of the arsenites, just as advised for the codling moth. In fact, fighting these insects gave us the knowledge of our best remedy for the apple-worm. As soon as the blighted leaves show that the enemy has come, the poison should be applied. It is easy, safe, sure, and what more can we desire? Here too, if the trees are in bearing, “we kill two birds with one stone,” the codling moth and the canker worm.

Tent Caterpillar.—*Clisiocampa Americana*, Harr. Family, *Bombycidae*. Order, *Lepidoptera*. These familiar insects, so sure to fix their silken tents within our trees, come just at the right time to do the greatest harm, and should never be left to their miserable work of despoilation.

NATURAL HISTORY.—These pretty moths (Fig. 32), brown in color, the female a little lighter and larger than the male, with two light bands running obliquely across the fore wings, appear in June and July. For the past four

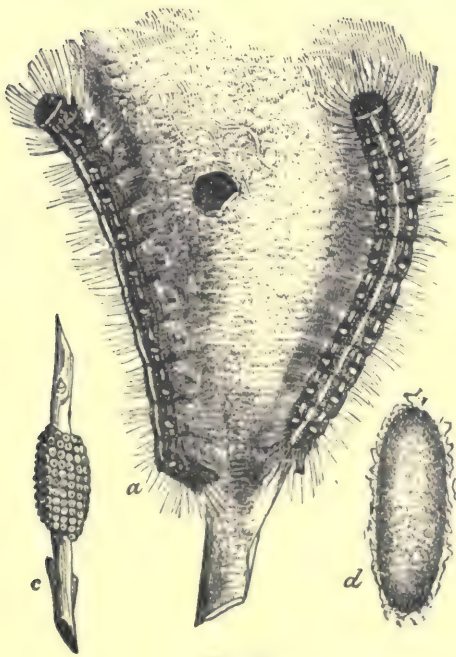


FIG. 32.



years I have taken the first of these during the first week of July, and those reared in confinement came forth at the same time. These moths, unlike the codling moth, are attracted by lights, and very frequently fly into our rooms

during our warm July evenings. After pairing, the female moths

lay their eggs (*c*, Fig. 32) in a compact cluster about the small twigs, covering them with a glistening glue, so that they are impervious to water. These eggs—three hundred or four hundred in a cluster—hatch just as the leaves of the apple and cherry are putting forth, on both of which trees they are wont to engage in their ruinous work, seeming rather to prefer the wild cherry. They immediately weave their tents, and become conspicuous objects in the orchard. They remain huddled in these tents, except when going forth to feed. They are quite regular in taking their meals, and usually all go forth at once. These larvæ or caterpillars (*a*, Fig. 32), variously striped with white, yellow, black and blue, are very handsome, feed voraciously, so that by the middle of June they are not only matured in size—being now two inches in length—but have managed to strip the trees pretty thoroughly of their leaves. They then disperse, seeking in all directions for some crevice in which they may form their closely woven cocoons undisturbed and unseen. They pupate almost immediately. In about two weeks they come forth as moths. And thus, the cycle of growth and change completed, the moth sallies forth to again prepare for future evil.

REMEDIES.—Among the many suggestions to destroy these pests, but one is worthy of adoption. As soon as the webs appear, go when the worms are in the tents, and by use of the hand, crush all the worms. This is easy, quick, and sure, and should never be neglected, as to strip the trees of leaves early in the season is very harmful.

The Fall Web Worm.—This insect comes in August; eats other leaves than those of the apple; feeds only while in the tent, and only eats the cuticle of the leaf. While these, coming so late, do little harm, compared with the tent caterpillar, they should be destroyed in the same way that we destroy that insect, for even neatness demands the death warrant, and they do harm the trees.

Plant Lice.—*Aphides*. Family, *Aphidæ*. Order, *Hemiptera*. As plant lice, some species of which attack nearly every kind of plant, are so preyed upon by natural enemies that they

are of little importance as enemies to out-door plants, I shall not discuss them in detail, only remarking that tobacco water, whale oil soap solution, or a weak solution of petroleum, will destroy them.

The kerosene and sour milk mixture is an excellent specific against plant lice. I have used one of kerosene to three of milk, without injuring the foliage, and yet all lice were killed. One to five I think perfectly safe on nearly all kinds of out-door plants. The mixture should be well stirred before use.

Plum Curculio.—*Conotrachelus nenuphar*, Herbst. Family, *Curculionidæ*. Order, *Coleoptera*. This little beetle, though so small, certainly ranks very high as an orchard pest. It is he that has almost banished plum culture in our State. It is he that ruins our cherries, often by wholesale. It is he that has a tooth for the luscious peach; and unless prevented, materially lessens the profits. And even our king of fruits, the apple, is frequently made to contribute to the support of the little Turk. His presence in wind-fall apples has misled some good observers into thinking that the codling moth larvæ had worked slightly on the apple and then left it. If this report could induce the restoration of plum culture in our country, by showing how easily we can secure our crops, it would pay its cost a million times over.

HABITS.—The curculio (Fig. 33 *c*) hibernates during the winter in the mature state. In early spring, and even later, he lies concealed by day under boards, clods, etc. This weevil is nocturnal, being active at night. So soon as our plums, peaches, and cherries set, the curculio, a little brown beetle, commences operations, imprinting the familiar crescent (Fig. 33. *d*) and placing an egg inside. This egg-laying continues even to July. As the weather becomes warmer the insect forsakes its habit of going down to the ground by day to hide, but remains in the tree. These beetles are not solely engaged in pairing and egg-laying, for they are good feeders, and gouge out many a hole in our fruits to satisfy their appetites. The eggs soon hatch, when the young larvæ bore into the fruit and continue to eat. As these are sometimes, though quite rarely, found in apples, I

would state that they can be easily told from the codling moth larvæ, as they are without legs, thus resembling maggots. They grow rapidly to maturity (Fig. 33, *a*), thus causing plums, apples, and peaches to fall prematurely, though cherries usually remain on the tree. The

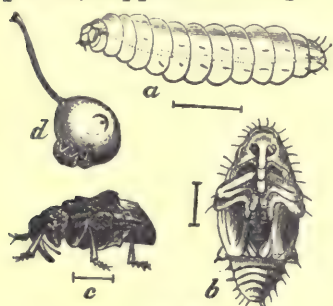


FIG. 33.

earliest larvæ are ready to go into the ground and pupate (Fig. 33, *b*) by the last of June. As egg-laying goes on even till July, it will readily be seen that larvæ will be found in the fruit all through the summer, and I have found them in peaches even in September. All of these pupæ change

into mature insects during summer and autumn, so the insects all pass the winter as mature beetles, concealed either under boards, or in crevices, or even in the ground. In May they commence coming forth, and continue to put in an appearance even to mid-summer. We see, then, that the old disputed question is settled—that these insects are single brooded, and that the old notion that they were double brooded, arose from the fact that some are so early, while others are very tardy in coming from their winter retreat; though it may be that those insects that appear so late in our orchards come from other orchards, or even from the forests.

As was said above, these insects are nocturnal, though they will fly in the hot sunshine. Yet they will fly more freely at night, and seem far less timid.

It is a fortunate peculiarity of this beetle to fall from the tree if it is suddenly jarred. In this condition, when it seems to contract itself to the utmost, it has been compared not inaptly to a dried bud.

REMEDIES.—Early in the season the curculio hides during the day beneath chip or clod at the base of the tree. Hence the peach growers of the “Michigan Fruit Belt” trap these weevils under chips early in the season. During the day they are gathered and destroyed. The gathering must not be commenced too early or delayed too late or we may fail to find all.

The jarring process alone will prove successful late in the season, and many use it exclusively. This consists in passing through the orchard, morning or evening, placing under each tree a sheet, and then giving the tree a sharp blow with a mallet, whereupon the insects will fall upon the sheet and can be gathered and destroyed. The sheet had best be fastened to a frame in the shape of an inverted umbrella, and carried on one or two wheels, if it is to be used extensively. A slit in the front, opposite the handles, allows the sheet to be brought under the tree. The size of the wheels and the sheet can be adjusted to suit the ideas of the orchardist and the size of his trees. If there are but few trees, the sheet can be tacked to a frame and carried by two persons. The mallet should be of rubber, so as not to mar the trees, though some saw off a limb or drive in a spike, in which case the blow will cause no injury to the tree.

In case of a few plum trees, it is well to have chickens confined beneath them. The jarring winds will bring the beetles down, when the chickens will pick them up. There is considerable evidence in favor of this plan. Still, with the present high price of plums, no one can afford to be without these trees, nor can we afford to leave them solely to the care of fowls, but should always practice the other method, which will insure good crops of this luscious fruit, and thus give us a luxury for our tables and money for our pockets.

I have had a fine annual crop of plums for several years. I use a padded mallet and a square sheet, tacked on one side to a pine strip as long as the side of the sheet. From the middle of the opposite side it is slitted to the center, and to the edge each side of the slit a light pine strip, half the length of the other strip, is tacked. This is light, easily handled, and convenient to bring immediately under the tree. As many know, we are greatly aided in our attempts to baffle the

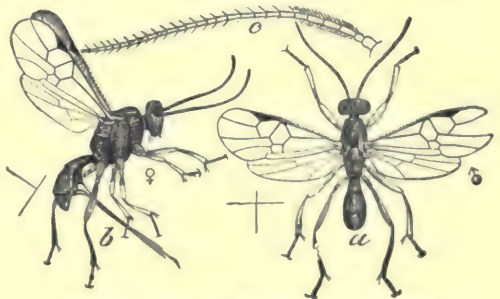


FIG. 34.—a, Male. b, Female. c, Antennæ.

evil attempts of injurious insects, by a host of parasites, chief among which are the ichneumon flies, which may readily be known by their long, compressed abdomens, and long, exerted ovipositors. It is wonderful, the instinct that guides these insect destroyers to their enemies. Even the plum curculio, secluded, as he is, and seemingly so exempt from molestation as a larva, has more than one of these wily foes to cut short his work of destruction. One of these (Fig. 34), the *Sigalphus curculionis*, Fitch, has been known to work on the curculio for a number of years. The female in the illustration shows the attitude in which the fatal thrust is made. It is very interesting to watch the operation of egg-laying, as I have frequently done, of another ichneumon during the past summer, on our currant "worms."

Peach Borer.—*Ageria exitosa*, Say. Family, *Ægereidæ*. Order, *Lepidoptera*.—This beautiful, slender, blue moth, which flies in the bright sunshine, is not as well known as the whitish caterpillar which does such pernicious work boring into our peach trees. In the recent statements from leading fruit men in Indiana and Michigan, where this pest has been so persistently and vigorously fought that it seems to be nearly exterminated, we have encouraging intimation of what concerted action, which this report is aiming to promote, will do in destroying any of our insects. Such news items should encourage all to enlist and press forward in the good work.

NATURAL HISTORY.—These gay moths (Fig. 35), resembling wasps in appearance, come forth in July, August, and September.



FIG. 35.—1, Male. 2, Female.

I have hatched them in all of these months. They soon pair, and then egg-laying commences. The eggs are laid just at the base of the trunk. Soon after the whitish larvæ will be

found, as they have commenced boring in the bark and sap-wood just beneath the surface of the ground. Wherever they work, just beneath the earth will be found a sticky mass formed of the oozing gum and their chip-dust, which gives quick indi-

cation of their presence. These larvæ are found of varying sizes, which is easily understood, from the fact of the length of time at which the moths come forth, from July to September. These larvæ will be found at work till about the first week of July, when we will often only find a pupa incased in a rough cocoon of chip-dust, earth, and gum. By seeking out these oval cocoons, any one may, by keeping them in earth in a close box, rear the beautiful moths. The female (1, Fig. 35), is larger, darker, than the male, and has a bright, yellow band across her abdomen. The male (2, Fig. 35), expands about an inch. In hatching a large number, I have found that the ratio of males to females is about one to five, which would seem to indicate that polygamy reigned among insects. In pushing out of their cocoon, the pupa skin is always left projecting from the opening. Perhaps the split cocoon serves them as a vise, thus aiding them to gain their freedom.

REMEDIES.—It has been recommended to mound the trees with earth in summer. Of course, the caterpillars will still work near the top of the mound. In fall, say the last of September, these mounds are pulled down, and the hot sun kills the tender-skinned larvæ. There are three objections to this plan: 1st. The mounds interfere with the Ransom process of fighting the curculio. 2d. Removing the earth in autumn endangers the trees during our severe winters. 3d. It is not absolutely safe.

The best method, and I believe a cheaper than the above, is to dig them out in the fall, the last of September. The oozing gum leads to their quick detection, when they can be easily crushed. Our best pomologists, for fear some wee depredators escaped detection, go over the trees again in May.

This is not a tedious process, and should never be neglected. I have seen whole orchards languishing, and many trees killed outright by neglect to destroy these hateful miners. Such neglect in case of a fruit so rare, so delicious, and so profitable wherever it can be successfully grown, is most unwise.

Judge J. G. Ramsdell, so well and favorably known as a pomologist, tells me of a new method of mounding which is without the usual objections, and he claims a great saving of

labor. He hooks tins around the trees—the same used to keep the cut-worm at bay. These are some larger than the tree, and four or five inches wide. He fills in between them and the tree with earth. This is done about the first week of July, after the cut-worms have ceased work, and in time for the first eggs of the borer. In September he removes the tins and destroys the caterpillars, which can be done with far less labor than when we have to dig them from beneath the earth at its usual level.

The late Secretary Bateham, of Ohio, was the first to recommend the carbolic acid mixture, already referred to in treating of the radish maggot and apple tree borers, to repel the peach borer. It should be turned on the earth at the base of the tree in July and August. It prevents the moth from egg-laying.

Pear or Cherry Tree Slugs.—*Selandria cerasi*, Peck. Family, *Tenthredinidæ*. Order, *Hymenoptera*. The destructive proclivities of these slimy “worms” are far too well known in our State. I have seen cherry trees in various localities badly injured by them, and the pear trees of one of our first pomologists almost destroyed. Few insects are so easily overcome; so with knowledge, vigilance, and promptness we may expect to soon be rid of a grievous pest.

NATURAL HISTORY.—The shining black fly, less than one-fourth of an inch-long, appears in early and late summer. The eggs are deposited on the under side of the leaves. The larvæ are brown, possess twenty feet, taper posteriorly, and are covered with a viscid, olive-colored slime, hence the name slug. Not all so-called slugs among insect larvæ are characterized by this unctuous covering, but all the larvæ of this destructive family may be quickly determined by the excessive number of legs, as they never contain less than eighteen, and sometimes as many as twenty-two. No other insect larvæ have to exceed sixteen, the number generally possessed by caterpillars. These larvæ only eat the cuticle of the leaf, thus causing it to turn brown and sere. In three or four weeks the larvæ have matured, and pass down the tree and enter the earth, where they

pupate, the flies of the first brood appearing late in August, those of the second late in May or early in June. These destructive insects belong to the very destructive family known as saw-flies, so named because of the wonderful organs terminating their bodies, which they use to form the groove for their eggs. As they may be seen in the microscope, these organs are very beautiful, and would serve well for models of our instruments of the same name. These cherry-tree slugs have been known to work on the plum tree, and some other of our shrubs.

REMEDIES.—The slime of these insects makes them peculiarly susceptible to any application like ashes, road dust (some deny that road dust is effectual), or lime. Hence, throwing any of the above substances into the tree where these insects are at work is sure to check their ravages. Such treatment goes to the root of the matter by destroying the source of the evil. These larvæ, as also those of other slugs, as the rose slug, so destructive in our State, and the pine tree slug, are destroyed by such solutions as white hellebore, quassia, Paris green with water, whale oil soap, carbolic acid, or coal oil. These last, of course, must be applied very weak, or the tree or plant will be injured. My friend, E. Reynolds, has killed the pine tree slug with Paris green, applied at my suggestion, one-half tablespoonful to a pail of water. The same remedy will banish the rose slug. The past season I have destroyed the rose slug, raspberry slug, and currant slug by use of pyrethrum, as recommended for cabbage-butterfly, and also by kerosene and sour milk, as used for squash-bug.

Plant Lice.—*Aphis mali*, Fabr., *A. cerasi*, Fabr. Family, *Aphidæ*. Order, *Hemiptera*. All our fruit men are familiar with the plant lice, as hardly a plant but suffers from the attack of some species. Yet, doubtless owing to the many natural enemies, and notwithstanding their wonderfully prolific tendencies, they are rarely very destructive. Sometimes they will attack a tree, and seem to draw heavily upon its vitality, and the very next year not a single louse will be found on the tree. I have noticed this repeatedly.

NATURAL HISTORY.—These aphides, sometimes green, as is the case with the apple and rose aphid, and sometimes black, as seen in the species attacking the cherry, pass the winter as eggs. I speak of those left out of doors. These hatch into females, which keep producing young, without any appearance of males, all summer through; so that the number of insects which may come from a single egg in a season is alarmingly prodigious. This may continue for eight or nine generations. But with the last brood in autumn there come forth true males and females. These pair and lay the eggs which are to produce the females in the succeeding spring. This kind of reproduction is not confined to plant lice. Other insects show the same peculiarity. In fact, it is a well demonstrated fact that drone bees are the product of unfertilized eggs. The two projecting tubes from the posterior parts of the flask-shaped bodies of these lice are called nectaries, as there exudes therefrom a sweet substance. This sweet secretion attracts the ants, hence the reason that we usually see plants attacked by lice also covered with ants. The lice and ants seem to dwell together very amicably. In fact, there seems to be an affection, not disinterested, to be sure, between them, as the ants caress the lice in a very loving manner, and in case of disturbance are very eager in their efforts to protect and care for the lice.

REMEDIES.—Syringing the plants with tobacco water is sure destruction to these insects. If limbs of small trees are alone attacked, they may be dipped in the fluid. Whale oil soap solution, and even common soap-suds are beneficial, while the kerosene and sour milk already recommended, is a sure remedy. I think that these insects, where they are exposed to our cold winters and to the host of lice destroyers, will never do great mischief; but in our green-houses and on our house plants they have full chance to work their ruin. But in these cases tobacco water and tobacco smoke are effectual preventives, and where else can this article, tobacco, be so appropriately used as in the destruction of these miserable lice?

Imported Currant Borer.—*Ageria tipuliformis*, Linn. Family, *Ageridae*. Order, *Lepidoptera*. This moth is widely

distributed through the United States, as the weak and dying currant bushes with their hollow stems clearly prove. As will be noticed, this beautiful wasp-like moth belongs to the same family and genus as the peach borer. The moths of this family may be readily told by their trim form, quick movements, diurnal habits, flying in the hot sunshine, and especially by the brush-like character of the tip of the body. This last character will serve to distinguish them from the wasps,—an important fact, as even entomologists of considerable experience are liable to be deceived, so striking is the resemblance. The larvæ of the family, so far as I know, are without exception borers. They are white with a brownish head, and generally pupate in a cocoon made of their own chips or dust.

DESCRIPTION AND NATURAL HISTORY.—The moth is a little less than one-half inch long, and expands three-fourths of an inch. The color is deep blue, with three yellow bands across the abdomen, a yellow collar, and yellow mixed with blue marking the legs. These yellow bands, so like the same in many of our wasps, render this species all the more liable to be mistaken, especially as they mingle with the wasps, making a gay company in the bright sunshine. Yet the tufted extremity, in lieu of a pointed one tipped with a dreaded spear, will quickly undeceive us.

These moths appear in June and July. They deposit their eggs near a bud, at which work they seem very busily engaged during the heat of the day. These eggs soon hatch, and the tiny caterpillar at once bores to the center of the stem. These larvæ may be found in the stem from June to July the following year. I have taken the moth from the bushes with my net, and the nearly full-grown larvæ from the hollow stem the same day, June 22d.

A curious example of wise foresight is afforded by these larvæ in their eating through the hard wood and bark before assuming the pupa state, as without such forecast and action the hollow stem would be a fatal dungeon to the moth, whose slender sucking tube and wanting jaws would render their escape hopeless.

These insects seem to attack the red currant more generally, yet the black variety, and even the gooseberry, is not exempt from its blasting work. Not only do the broken stems, so weakened as to be unable to stand upright, but also the sickly appearance of the foliage tell of this insect's presence and work. Bending the stocks will also generally give the needed information, as the affected ones bend more readily. The hollows in stocks cut across will inform us of their previous or present work.

REMEDIES.—It has been suggested that we catch the moths. I think this is not a practical remedy. The moths are so small, so quick, so wasp-like, that I should despair of this ever becoming generally practiced. I would suggest letting the bushes sprout up pretty freely, and then each spring practice heavy pruning, taking pains to cut and burn the feeble and limber stocks. This should be done about May 20th; if later, some of the earlier moths might escape, if earlier, the pruner could not discriminate so wisely between healthy and diseased stems.

Imported Gooseberry Saw-Fly.—*Nematus ventricosus*, Klug. Family, *Tenthredinidæ*. Order, *Hymenoptera*. This gooseberry (or currant) slug is a fearful devastator, often completely defoliating the bushes the first year that it appears.

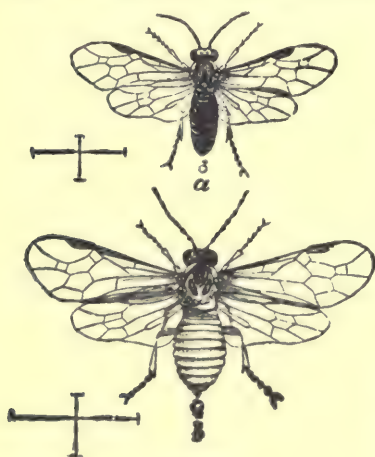


FIG. 36.

NATURAL HISTORY.—The yellow female saw-fly (Fig 36, *b*), about the size of the house-fly, with black head, meets the smaller male (Fig. 37, *a*) which has more black, and commences laying her whitish transparent eggs along the veins underneath the leaf, about the first of May. These hatch in three or four days, and the green twenty-legged "worms" (Fig 37, *a*)

dotted with black until the last moult, when they are entirely green, commence immediately to feed on the leaves. These larvæ eat voraciously, and soon become full grown, being then

three-fourths of an inch long. These larvæ either go into the earth, under leaves, or remain attached to the bushes, and spin a cocoon of brownish silk. The larvæ will be found at work till in July, as there are two broods each season. They remain as pupæ till the following spring, when the flies come forth to repeat the round of mischief.

REMEDIES.—Prevention being universally conceded to be better than cure, all should be certain not to import these insects in procuring the plants. As the cocoons are hid in spring among the roots, these should be carefully washed and the material washed off and burned. The absence of such precautionary measures accounts for the rapid spread of these pests. The leaves when first worked on are perforated with small holes (Fig. 37). As there are comparatively few, the eggs being so compactly placed that but few leaves receive them, they can be gathered and burned. But if we have failed, either through ignorance or neglect, to destroy these destroyers till they become scattered over the bushes, we still can offer effectual battle. White hellebore, dusted upon the vine in the same manner that we would recommend for applying the Paris green mixture on the potato, is sure destruction to these “worms.” This is the best applied when there is little or no wind; and, though poisonous, is entirely safe if used cautiously. If it is preferred, as in most cases it doubtless will be, the hellebore may be mixed with water and applied with a sprinkler, in which case we are independent of wind, and can not inhale it. An ounce to a pail of water is sufficient. As it costs but forty cents per pound, it will be seen that it is not expensive.



FIG. 37.

Climbing Cut-Worms.—*Agrotis messoria*, Harr. Were the climbing cut-worms as destructive in all sections of our

country as they are in some places these insects would rank next to the codling moth as a pest of the orchardist, and even now they occupy no inferior position. They not only strip the buds from our fruit trees, but the various vines also minister to their appetites.

NATURAL HISTORY.—Little need be said on this subject farther than what has been said in reference to field cut-worms, as the characters of the various cut-worms are very similar, as also their habits; yet, just before the larvæ mature, the climbing species exhibit a strange peculiarity, as during the warm summer nights they come forth from their earthen retreats, not to nip the tender corn or tomato plant, but to climb some apple, pear, or peach tree, or some grape vine, and eat out the tender buds, thus frequently doing irreparable damage. The owner sees the damage, but not the enemy, and all ignorant of the true cause, says hard things of his bird friends. These larvæ hide by day just beneath the ground, where they may be found by a little digging. They may also be seen by climbing into the trees by night or by shaking the same, when the “worms” will fall to the earth. There are two or three species in our State that I am sure have this climbing habit; there may be several.

REMEDIES.—In addition to the process of digging out by hand, recommended to destroy field cut-worms, and placing armfuls of fresh clover to entrap the larvæ, as already suggested to the gardener, there are still other methods to fight or ward off the climbing species. They can be caught by using the sheet and mallet at night, as in fighting the curculio when they are in the tree. They may also be kept from gaining access to the tree or vines at all. To protect vines Professor Tracy recommends using stiff, smooth paper, about four inches wide. He winds this about the trunk, gathering in at the top, and tying about this gathered portion with a cord, drawing it tightly. The lower portion is permitted to stand out a little from the tree, so the whole resembles an inverted tunnel. For larger trees, and indeed for small trees and vines, the same is often used, but tin bands will be most desirable. The tin should be thin and bright, and should be cut into strips about three inches wide,

and of a length to correspond to the size of the trees to be protected. When these are drawn closely about the tree they should lap sufficiently to be tacked or nailed through the lap: a hole should be made through one end of the tins with a punch, then in placing the tins on the tree the end with the hole should lap over the other end, and if a lath nail is used this may be made by a smart blow to pass through the other end, and into the tree. The nail should only be driven partially in so as to be easily pulled out when the tins are to be laid away. By making a narrow slit in the other end of the tin to correspond with the hole when the tin is lapped, it can be fastened by a common carpet tack, in which case the tack should only be driven partially into the tree. Professor Tracy recommends that the tin be tacked or nailed near the upper edge. This tin is a sure preventive, for the cut-worm can not pass over the surface of smooth tin. Judge Ramsdell would have the tins longer, and fasten by hooking, as the ends are bent for that purpose. He thinks there is little danger of the larva passing between the band and tree. He uses these same bands in fighting the peach-borer, as already described.

As these pests work far worse on sandy land, those having orchards on light soil will have to be specially vigilant.

The Rose Chafer.—*Macrodactylus subspinosus*, Fabr. Family, *Scarabeidæ*. Order, *Coleoptera*. As this old pest of the rose is becoming quite destructive to the grape in various sections of our country I will give it brief attention.

NATURAL HISTORY.—Its history and habits closely resemble those of its family relation, the May beetle, already described. The beetles appear in June and July; eat most ravenously, seeming to relish rose leaves, grape leaves, and even cherry leaves. After this wedding feast is over, the females lay their eggs in the ground. The grubs feed on the roots of plants, but are not sufficiently destructive to attract attention. The pupæ may be found in May, and in June the beetles come forth again.

REMEDIES.—As this beetle will, like the curculio and blister beetles, fall from the plants whenever disturbed, they may be shaken onto sheets placed under the vines, and destroyed.

It is said that Paris green is no help in warding off these beetles. Occasionally a person states that he has defeated them by the use of this poison. Is it not probable that the arsenites will kill them, but that they come in such armies that where one falls two are ready to take its place? Were I confronted by this host of destroyers, I should try Paris green, or London-purple, the kerosene and sour milk, and the pyrethrum in hopes of finding an easier way to banish them, than that of jarring them onto sheets and killing them.

Space will only permit a brief mention of several insects which often do serious damage.

The Army Worm.—Fortunately these insects appear in destroying numbers so rarely that, though sometimes they commit terrible havoc, they are not a great source of annoyance with our farmers. Paris green will poison them; but they invade the oat fields in such numbers that this is not a practical cure. The best way to keep them away is to dig a ditch on the side of the field which they approach with a steep side toward the field. Every few feet at the bottom of the ditch something like post holes are dug. These catch the worms, which by use of a sort of pounding stick we may destroy *en masse*. The National Agricultural Reports treat elaborately of this insect.

The Cotton Worm.—This terrible pest of the South is best destroyed by use of London purple, as already described. Hose carts made purposely to apply the poison mixed with water are extensively used. This insect is also fully considered in the reports of the Department of Agriculture.

The Cotton Boll Worm of the South, or Corn Worm of the West.—These insects, which fed extensively on the ears of green corn as far north as Michigan in 1881, are very destructive South and West. These insects in the mature or moth stage, like the cut worm moths, are attracted by sour milk, by sirup, and by bright lights, which suggests ways to destroy them.

Lice and Mites.—These insects, which attack our domestic animals, often work quite serious mischief. They cause the poultry to languish, and our larger animals to become poor and

feeble. A salve made by mixing kerosene and lard or kerosene and sulphur is an excellent specific against these pests. In case of poultry, it should be rubbed on the roost poles and on various parts of the body of the fowl. On cattle or larger animals it should be rubbed on the bodies where the lice are thickest. A decoction made by steeping tobacco stems will quickly kill lice on any animal if the latter is washed with it. In winter this is troublesome to apply. Ticks on sheep can be destroyed by dipping in tobacco water. I have killed sheep ticks by smoking with tobacco, making use of a common bee smoker. Long-wool sheep are most affected. It is quite easy to part the long coat and apply the poisonous fumes.

Pyrethrum is excellent to destroy lice and mites on our domestic animals. In close buildings it may be blown into the rooms containing the affected animals, or it may be rubbed on the skin between the hairs or feathers.

Space forbids further mention of our insect enemies. With the hints already given, the wise, thoughtful man may be able to treat others not mentioned.

For those eating foliage which is not to be fed to animals, like that of the potato and our fruit and shade trees, use the arsenites. On cabbage and currants, where these virulent poisons are not safe, use pyrethrum. For the sucking insects, like plant lice or bugs, the kerosene and milk will prove effectual. Kerosene and carbolic acid are excellent to repel insects and so prevent egg-laying, as suggested in case of the apple-tree and peach-tree borers. Bisulphide of carbon is a most excellent insecticide when the insects can be confined in a close box, like grain weevils, etc. We must remember, however, that the vapors are very explosive.

CHAPTER XIV.

TIMBER GROWING FOR PROFIT.

THE wanton waste and destruction of timber in the United States is unparalleled. Dr. Townshend, in a lecture on forestry at the State University at Columbus, Ohio, stated that in twenty-five years the area of timber in the United States had been reduced more than one-half. In many localities I have seen the farmer deadening and burning the timber on his land, or giving it to any one who would take it away, and in less than twenty years in the same locality the scarcity was so great that timber lands were worth double the price of those that were cleared, and often a single tree would bring the price of an acre of land. In the absence of any laws regulating the amount of forests in this country, the only way to secure a proper quantity of timber seems to be to appeal to the farmer's pocket and show him that the growing of timber can be made profitable, thus enlisting the same motive in the work of replacing our forests which has led to their destruction.

Scarcely one farmer in a thousand has any experience in growing timber, and to most of them it seems so great an undertaking, and one requiring so great length of time and beset by so many difficulties, that they are inclined to leave it to the next generation. I have been fortunately situated for observing the growth of forest trees, particularly the black locust, and am able to show conclusively that on cheap lands, to which it is adapted, there is no farm product which can be grown at so large a profit, and that instead of planting for the next generation, a man may sell two or three crops from the same plot during an ordinary life-time, or may have a steady income for many years from a locust plantation.

Before going into details as to how to plant, cultivate, and care for timber to make it profitable, there are a few facts which I wish to impress. 1st. The area of timber in the United States is rapidly decreasing, while the consumption is increasing. The value of the annual product of sawed lumber for the ten years included in the last census, 1870 to 1880, was in round numbers two hundred and thirty-three million dollars. At the present rate of consumption the supply will not last a generation. 2d. Under these circumstances prices must advance, for it is certain that the demand will exceed the supply. 3d. The attention of farmers generally has not been called to this subject, and for many years to come there will be but little systematic tree-planting, which insures a large profit to those who first engage in it. 4th. Aside from the question of pecuniary profit, there are many incidental advantages connected with timber planting which are worthy of attention.

Forests temper the heat of summer and break the cold winds of winter, and the history of many wooded countries that have been stripped of their timber shows that drought and floods were greatly increased in severity thereby. The value of shelter belts of timber both for the protection of stock and crops has been shown on the prairies, and when even one-sixth of the land has been devoted to this purpose, it has been found that the remainder produced as much grain as the entire amount without such protection. The humidity of the atmosphere is largely affected by the leaves of growing forests, and while I think the danger of our country becoming rainless by the depletion of its forests has been exaggerated, I am sure that much further reduction of forest would be unfavorable.

The effect of forests upon the beauty of the landscape is worth taking into account in connection with the question of tree-planting, for there are few sights more lovely than a landscape dotted with forests, with light and shadow playing upon them, or with the vivid green of midsummer or the brilliant tints of autumn. Much of our steep hill land is liable to wash, and on some soils this can only be prevented by the roots of growing trees. There are hillsides now gullied and seamed so that they

produce no grass, which can only be clothed with verdure again by first planting trees upon them.

Another fact not generally known to farmers is that trees will make a profitable growth on lands that have been so exhausted by cropping or even by washing that they will not produce a crop of grain that will pay for cultivating, and also on wet, cold lands that would not produce grain without drainage. It is also true—of some varieties of timber, at least, and on some lands—that more grass will be produced with the trees growing than if the land was bare. This is especially true of lands that have a steep southern slope, so as to receive the rays of the sun almost vertically, for without shade the grass will be burned out. These southern slopes when planted in timber produce the earliest pasture, for the fallen leaves protect the grass through the winter, and it starts early and makes a large growth before the trees leave out in the spring. Botany teaches us that plants have their affinities and dislikes, and locust-trees and blue grass illustrate the first, for while this grass may not be as nutritious when grown in a locust plantation, it produces as large a crop, and on some lands very much more, than if there were no trees growing.

What Trees to Plant.—The tree planter must be governed by his soil and needs in determining this question. It would be unwise to plant largely of varieties that do not grow naturally in your locality, at least until they had been tested. In all localities where the black locust flourishes it will without doubt furnish valuable timber, and be ready for market sooner than any other. Where a quick growth is wanted for a shelter belt or where the object is to grow a supply of fire-wood as soon as possible, I doubt if any thing better than the soft maple can be had, although in some localities the box elder or cotton-wood might be preferable, or on wet soils some variety of willow.

On many farms there are fields which might be fenced with lines of osage hedge and these allowed to grow into timber, while at the same time they were utilized for fences. In other localities, where evergreens flourish, they will be found profitable. When the object is to establish a permanent forest, with-

out regard to quick returns, hard or sugar maple, ash, oak, and black walnut will be found profitable varieties, and on soils and in localities suited to it, the American sweet chestnut. I do not recommend the catalpa, because its crooked habit of growth prevents it from being valuable for timber, and there are other trees more profitable for fire-wood.

Where to Plant.—As a rule, timber should be planted on land unsuited for cultivation—hillsides or small, ill-shaped detached pieces of land separated from the other parts of the farm by a road or stream. The exceptions to this are on farms where all the land is level and suitable for cultivation, or where it is desirable to plant for a wind-break across the end of a level field. Clumps or borders of trees should be planted in the permanent pastures, or rows of them may be planted along the fences adjoining these pastures. Wherever a field is exposed to the west winds, a strip one or two rods wide across that side of the field may be profitably devoted to a belt of trees, as they will furnish protection to grain and stock, and at the same time be growing into valuable timber. In most localities the waste lands if planted in timber would give a large area, and perhaps all that would be necessary to preserve a proper balance between timbered and cultivated lands.

How to Plant.—A great deal of foolish advice is given about starting a timber plantation. A majority of the farmers whom I have heard talk about it, think that all that is necessary is to keep the cattle out of the wood lots and allow them to renew themselves, or that the seed should be sown broadcast, and if the trees come up too thick allow them to thin themselves by a natural process. This is as unwise as it would be to depend on our wheat fields reseeding themselves from the shattered grain. We need as thorough preparation of the soil for planting a forest as for putting out a grain crop, and the land should be fully occupied.

Nature is prodigal. She sows a million seeds for one tree that comes to maturity, and the work assigned to man is to improve on nature. Nature starts a hundred trees on a square rod and leaves a dozen rods without any. Man improves, and

systematizes the work by planting the trees so that they can be cultivated and so that all the land will be occupied. Nature is never hurried, it makes no difference to her if a hundred years pass before the tree is large enough to be valuable, but man can not afford to wait. As a rule it is not well to replant the old wood lots, for it is better to start our timber plots on old worn fields and leave the fresh virgin soil of the wood lot—when cleared—for grain.

Forest trees should be started in a nursery, and transplanted at one or two years old. The quick-growing varieties, such as the locust and soft maple, should be transplanted at one year old, as if they have received proper care they will have attained sufficient size by that time. Most varieties can be bought at from two to fifteen dollars per thousand, of nurserymen who make a specialty of growing them, and some the farmer can grow himself. The soft maples mature their seed early in May, and this may be gathered and planted immediately, and with good care the trees will grow from three to five feet high the first summer. All forest trees should be thoroughly cultivated after being set out in the plantation, till they are well established and have made a good start to grow. Under favorable circumstances they will only require to be cultivated the first season after transplanting, but two, or even three years of cultivation will often pay. As a rule they should be planted much thicker than they are to stand, as this will induce a straight, upward growth.

My first planting of forest trees was made in 1863, at which time I planted a lot of soft maples and evergreens. The maples were two years old from seed and the evergreens about two feet high. In twenty years the largest of these maples standing singly girted forty-six inches, four feet above the ground, and those standing in a row at an average distance of three feet apart in the row, had a circumference varying from twenty-five to thirty-five inches at the same height, and carried a good-sized trunk to the height of twenty-five feet. The Austrian pines averaged forty inches in circumference near the ground, and thirty inches as high up as I could reach. In 1872

I set one thousand soft-maple trees in nursery rows, planting them one foot apart in the row, the plot comprising about one-tenth of an acre. Nine years later I cut a half cord of wood from eighteen of these trees, occupying one row fifty feet long, the rows having been thinned by digging shade trees. I do not consider these growths remarkable, and think it would be easy to find timber plots that have done better.

Locust Growing.—In all localities where it will flourish—and it adapts itself to a great variety of soils and a wide range of climate—it is doubtful if any tree can compare with the locust for profit. The valuable variety is known both as the black and yellow locust, and both names are given to it in the catalogues. The botanical name is *Robinia pseudacacia*. It has short thorns, quite sharp and plenty on the young trees, but they become few and blunt as the tree gets older. (This should not be confounded with the honey locust, which has long sharp thorns, and is of but little value for timber.) It is extremely hardy, can be grown easily from seed, bears transplanting well, makes a very rapid growth, and is surpassed by few if any varieties of timber for durability. I have seen posts of this timber still in a good state of preservation that had been in use for thirty-five years. Another thing which adds to its value is that it has but little sap-wood, and the trees may be cut as soon as their diameter is sufficient for a post, and will be nearly or quite as durable as older timber. A plantation once started is for life, for when cut off, it at once renews itself, and the second crop will be large enough for posts in about three years less time than the first grew.

I have watched the growth of locust timber grown from the seed, for more than thirty years, and have seen the same plot cut and marketed twice in that time, and for five years I have been planting an average of about one thousand trees a year, so it will be seen that I speak from experience in the matter. The first locust plantation that I ever saw planted was in the spring of 1850. The seed was dropped in hills four feet apart each way, where it was to grow. I would never recommend this plan, as some hills will be crowded and others

vacant, and the young plants are not likely to receive the care they require when scattered over so much land. Enough plants to set an acre can be grown on from five to ten square rods, and it is always best to grow the plants in the nursery, and at least one year will be gained by this plan.

The plantation above mentioned was cut off clean and marketed in 1868, but as the owner is dead I have no means of knowing what amount of money was realized, but I know that it was several hundred dollars per acre. The trees had been thinned first for bean poles, and when larger for fence stakes, until at the time it was cut off clean they stood about eight feet apart each way, or at the rate of six hundred and forty to the acre.

In 1879, eleven years from the time it was cut clean, I noticed the owner bringing out a load of posts from it, and I made a careful examination of the plot. I found that each stump had thrown up from three to seven sprouts, the largest of which were now being cut, and I estimated that there were from twenty-five hundred to three thousand trees to the acre. This thinning process has now been carried on for five years, and in the spring of 1881 over four hundred posts to the acre were cut, and there are still trees enough left to make a dense forest. This plantation is on a piece of level land that is separated from the rest of the farm by a ravine.

A few years later, about 1856, I think, the same man planted eight acres of steep hill-side in locust. The land slopes to the south, and is of irregular shape, following the windings of a creek. As this plot lies near the road, I have seen it almost every day for twenty-five years, and have been able to watch the growth of the trees, and to note the product of grass. As soon as the trees were out of the way of calves, blue-grass was sown, and for twenty years the sod has been undisturbed, for when the first growth of timber was cut off in 1870, the field was not plowed. In the spring of 1883 I examined it, and found from two hundred to five hundred trees growing to the acre, two-thirds of them large enough for posts, and tall enough to make two cuts to the tree. There had been several hundred

posts cut to the acre from this plot, so that the trees now stood in clumps of from three to five, in rows about one rod apart each way.

In the summer of 1883 the present owner of this land, at my request, examined his books to see what his sales had been, and he reported 6,608 posts and stakes sold in four years, at an average price of fifteen cents each, making \$991.20. The farm, which contains one hundred acres, has been rented at \$350 a year during this time, and the income from these ten acres—eight of which are unfit to cultivate—has averaged \$247.80 per year for the four years. The larger part of the posts were from the thinnings of the grove, and there can be as many more sold during the next four years, and the plantation is continually renewing itself. In my judgment this land has produced double the grass that it would have done if exposed to the sun, and while I do not think it is as nutritious as that grown in the open field, young stock do fairly well on it.

In the spring of 1867, thirty-three locust trees, which stood in a row not far from my house, were cut and made into posts. I do not know the age of these trees, as they were standing when I moved to the State in 1848, but they were not far from twenty-five years old at the time of cutting. They made an average of twelve good posts and six fence stakes each, and the wood from the limbs paid for cutting and splitting the posts. There grew from the stumps and roots of this row two hundred trees, and when the owner, thirteen years later, began cutting posts from them, I found that the largest of them would make four post lengths, and were large enough to split into two posts at the butt, and second cut. In the fall of 1883 I again examined this plot, and counted one hundred trees large enough for posts (although many had been cut), and nearly as many smaller ones. This hundred trees would average three posts to the tree, and as there was but an eighth acre of land occupied this would give a handsome profit.

My first planting of locust (1,800 trees), was made on a piece of cold, wet land, which I could not conveniently drain. The soil is a heavy clay, with a compact yellow clay subsoil.

The trees have made an excellent growth, and now, at six years old, are large enough for fence stakes. Four years ago I planted a row of locusts trees (one year old from seed), four feet apart in the row, between a cultivated field and a piece of permanent pasture which lay north of it. The row is fifty rods long, and I designed to use the trees for posts, either attaching wires to them or setting up light panels of board fence against them. The spring they were set we had the driest May I ever remember, and all the trees died down to the ground, but on the 30th day of May a soaking rain revived them, and they started from the root, and every tree grew. As this growth was not strong or straight as I wished, I cut them back to the ground the following spring, and rubbed off all but one sprout, when they started to grow. Three summers' growth made these trees strong enough to support panels of fence, but I made instead a brush fence by weaving hedge brush between them at a cost of eight cents per rod, as you will find described in the chapter on fences. In one place this row of trees crosses a knoll from which the soil has been washed, leaving the yellow clay, and here the trees have grown as strong and healthy as on the richer land, although the spot would not produce grain enough to pay for cultivation.

Another point to be considered in growing timber is that taxes are light. The land in locust which I refer to and which has paid nearly twenty-five dollars a year for posts sold, is not taxed any heavier than similar land on adjoining farms, which does not pay to the owners two dollars an acre. In many States there is a special provision which exempts from taxation land planted in timber, and I have never known it to be taxed more heavily than similar land adjoining.

How to Start a Locust Plantation.—The seed should be sown in nursery rows. The best time to sow is about corn planting time, but fair sized plants can be grown from seed sown as late as the middle of June. The seed must be scalded, as without this preparation, not one seed in a hundred will grow. Put the seed in a water-tight vessel and pour over it water nearly boiling; let it stand till cool. You will find a part of the

seeds swollen to about four times the ordinary size. Sometimes nearly half the seed will swell from the first application of water, but generally but a small per cent.

The swollen seeds must be separated from the others. With a small quantity this can be done by hand, but it is more convenient to do it with a sieve, and I find that the right size is five meshes to the inch. I have a mason's hand screen which I use for this purpose. After separating the swollen seeds, apply the hot water again and go through the same process, and it is often necessary to repeat it five or six times before all the seed will swell. As it is difficult to sift the seed when wet, spread it thinly in the sun and allow it to dry, but it should not remain any longer than is necessary to dry the outside. This swollen seed is ready to plant and will come up as quickly and certainly as corn, but if the weather should be unsuitable for planting, it can be kept safely for several days by spreading not more than an inch deep, covering with a damp cloth, and setting on the cellar floor or in some cool, damp place. Sow in drills about a seed to the inch, and wide enough so as to admit of horse culture; keep them free from weeds and thoroughly worked all summer, and they will grow from three to five feet high.

Always set out in plantation at one year old. The expense of taking them up and planting will be less than half what it would if left another year, and the trees will scarcely be checked in their growth, while if left till two years old the roots will be mutilated so that the trees will be much injured in transplanting.

The soil in the plantation should be thoroughly prepared by plowing, harrowing, and rolling, as the work of setting out can be done much better and more rapidly than if it is left rough and cloddy. My plantations are set in rows both ways, four feet apart each way, and we are now thinning to eight feet, cutting out for bean poles and fence stakes. In my future planting I shall adopt the plan of making the rows eight feet apart, and plant quite close in the row. Where there is a demand for bean poles it will pay to set one foot apart, and I would not set wider than two feet apart in the row. This close planting causes a straight, upright growth, and the advantage of planting

thickly in rows eight feet apart rather than four by four is, that it gives a better chance to select the best trees in thinning. Often two nice, straight trees may be left within two or three feet of each other till one is large enough for a post. The secret of a profitable crop is having the land well occupied, and this way of planting gives a better opportunity to do this.

When the land is thoroughly prepared, lay it off with a two horse plow so as to make a deep furrow. Two men and a boy will work to the best advantage. The boy holds the tree upright while the men shovel the earth to the roots and tramp it solid. They should be cultivated for one year at least, and two are better. In planting the trees it is best to assort, and put the large and small ones separate, as, if a large and small tree are set side by side, the large one usually gets the start and the other is overshadowed. No tree excels the locust in hardiness, and with ordinary care, scarcely one tree in a thousand will die. If from drought or any other cause, the first summer's growth is not satisfactory, it is a good plan to cut back close to the ground the next spring, as by this time the roots will be well developed, and the trees will make a strong, straight growth. If this is done, it will be necessary to rub off all the sprouts but one. A little trimming will be of advantage for a few years, removing side branches and bringing the trees into good shape, and this may be done during the leisure of winter. As the trees attain a sufficient size to be of value, cut out where they are thickest until the number is reduced to six or eight hundred to the acre.

After the trees are four years old, the plantation may be seeded to grass and pastured—at first with young cattle. I think pasturing an advantage while the thinning is being done, as the stock will keep down the sprouts. When the plantation is cleared, the stock must be kept out two years or until the second growth is out of their way. The second growth is more rapid than the first, as the old roots nourish the young plants and cause a growth of eight or ten feet the first summer. In locations where the locust trees grow, the farmer can save his own seed. It may be gathered any time from October to May,

and those who can not gather it can get it from our seedsmen, as most of them now advertise it at about one dollar per pound, post-paid. A pound contains about twenty-five thousand seeds, but it is not safe to count on more than one-fourth this number of perfect plants, and it will require care and experience to get even half this amount.

Taking into consideration all the facts presented, it would seem that few investments are offered that are so sure of large profit with little risk, expense, or taxes, as the planting of locust timber on all soils where it flourishes, and I most heartily recommend it, especially to the young farmer in all locations where timber is becoming scarce.

The only enemy to this tree that I have ever seen is the borer, and it does not often seriously injure large plantations, particularly where the soil and cultivation is such as to insure a rapid growth. I do not think the danger from the borer worth taking into consideration under good management.

CHAPTER XV.

THE HOME AND ITS SURROUNDINGS.

AN estimable member of the society of Friends when asked why he was so particular about his daily conduct, replied; "God has given me but one journey through life, and I can not come back to rectify mistakes." It seems to me that many farmers make a mistake which involves the happiness of their lives and that of their families, by looking upon the farm as merely something to dig money out of. They become strict utilitarians, and bring every thing to the standard of dollars and cents, and believe flowers, shrubbery, walks, etc., to be useless vanities.

These tendencies are likely to grow with age, until the words of the poet become literally true, when he says of the old farmer:

"He had some notions which did not improve him:
He never kissed his children, so they say;
And fairest flowers and finest scenes would move him
Less than a horseshoe picked up by the way.

He could see naught but vanity in beauty,
And only weakness in a fond caress;
And pitied those whose views of Christian duty
Allowed indulgence in such foolishness."

I have little doubt that the utter want of attractiveness about many farmers' homes, with the uncouthness bred by these surroundings, has driven more boys from the farm than the hard work. There are no pleasures so inexpensive as those which can be had by surrounding a country home with trees, flowers, and shrubs, and none more refining in their influence. No other home brings the children so closely into communion with nature, or gives so good an opportunity to train eye, mind, and hand.

God bless our country homes; they are the hope of the nation, and whether our children are to remain in them, or go out to some other sphere of duty, we should, as far as possible, make every thing else on the farm subordinate to the home, so that they will always look back to it with longing, if duty calls them away, or if they remain, have no feeling that farm life is degrading, but be contented and happy in their calling.

The past decade has witnessed a marked improvement in the surroundings of country homes, which is due partly to growing wealth and intelligence, partly to the influence of the agricultural papers, and the beautiful catalogues with which our seedsmen have flooded the country, but perhaps most of all to the example of those who were pioneers in the work. No good example is more contagious than this, and in any neighborhood where one family begins the good work of rendering the home attractive, others are sure to attempt it.

To say all that might be said on this subject would call for the writing of a book, and in a brief chapter I can only hope to call attention to some points which the intelligent reader must develop for himself.

Location of the House.—Most of those who read this chapter will not build their own houses, but must take such as they find and do the best they can with them. Still, as most persons build at some period of their lives, it seems legitimate to treat of this subject. In locating the farm-house a number of points should be considered.

One of the first of these is health. The house should be so located as to secure thorough drainage. I have known farm-houses built on flat land, where the soil was a tenacious clay, with the floors not more than a foot above the level of the land, involving the digging of a long drain, and perhaps making it difficult to drain the cellar at all. I have known families to live all winter with three or four feet of water in the cellar under the sitting-room because of this defect. If possible, a slight elevation should be chosen for the house, but if you must build on flat land, dig a cellar but three feet deep, and then at a suitable distance from the house, plow and scrape till you have

made a regular grade. In many cases this will cost less than to dig a deep cellar, and will not only give good surface drainage, but a good outlet for the drain.

The position of the home in relation to the barn should be such that there could be no possibility of contamination of the water from the barn-yard drainage, and while the barn should be near enough so that too much time would not be lost in going back and forth, it should not be so near as to contaminate air or water, and should not be in the direction of prevailing winds. Where I live the best direction for the barn is north, for when the wind is in that direction, the weather is usually bright and clear, with a strong breeze, which purifies the air, while with the wind southerly, we often have muggy weather with a heavy, oppressive atmosphere. This matter of drainage and location of barn and other out-buildings in their relation to health, can not be urged too strongly, or receive too careful attention.

Convenience to farm, road, etc., should be carefully considered in locating the buildings. I would not build away from the road in order to save a little distance in drawing the crops from the fields, but would get as near the center of the farm as possible, consistent with convenience to the road, as a little saving on each trip to the fields, when these are to be repeated daily or oftener, for a life-time, will amount to a large aggregate.

Size of House Lot.—This must depend to some extent on the size of the farm, the lay of the land, and the size and style of the buildings. A small yard, well cared for, is better than a large one neglected.

I do not think, however, that a farm house should ever have a little box of a front yard, and there are few farms where there should be less than a half-acre devoted to the yard. When the farm is large, and the owner wealthy, several acres can often be well set apart for ornamental purposes. The distance of the house from the road must be governed by the grade, style of house, size of yard, etc., but I think should never be less than forty or fifty feet, and the yard should extend at the sides somewhat farther. I consider an east front

much the most desirable, as it gives a cool shaded yard in the afternoon and evening during the summer, but if one lives east of the road, and must build facing the west, I would advise a south portico and frontage, and an arrangement of trees to secure shade.

The size of the house must depend largely on the means of the owner, but a small house may be made tasty, and be conveniently arranged, as well as a large and expensive one. A building plan should never be decided on hastily, but every detail should be carefully studied, and before the work is begun you should know to a dollar what the house is to cost. Many people think this impossible, and hundreds have begun to build expecting to get through on a certain sum and have found the cost double what they had estimated. This comes from beginning the work without thorough preparation. Even if there is a contract with the builder to put up the house at a given price, if the plan is changed after the work is begun it annuls the contract and gives an opportunity for extra charges, which often increase the cost greatly.

Settle your plan fully before you begin if it takes a year. Spare no time or expense to know that your plan is one that you will be satisfied with. Get illustrated books on house building, and study the plans given, take your wife with you and visit all the best houses near you, and note their defects as well as their excellencies; and when sure your plan will suit you, have a contract drawn which shall cover every detail, and specify every point, and give out the job to a competent, honest builder, and you will have no extras to pay for when the work is done. I feel that I can not emphasize this point too strongly, as I have known so many cases where the cost of a house has exceeded by from five hundred to one thousand dollars what was expected, leaving the builder burdened with a debt which he had not anticipated and would not have knowingly contracted. My own experience in building shows that it is as easy to know the cost of a house before its erection is begun as it is when completed, or as it is that of a farm or any other piece of property.

If your funds are limited and you must put up a small house, it is often wise to build so that you can add to it at some future time, and the possibility of this must be considered, for if the part built first is to be a wing, and a front to be added, it must be set far enough back to allow room for the front without contracting the yard too much, and in planting shade trees this must be borne in mind. It is sometimes wise to build the house as large as you expect to need it and defer finishing and furnishing a part of it till some future time when you can better afford it. One should never lose sight of the fact that a large and expensive house calls for expensive furnishing, and therefore all spare means should not be put into the building.

One point which should be kept in mind in building is thoroughness. Use only good material. There is no economy in green lumber, sappy shingles, or poor material of any kind; better have three rooms built substantially of good material than twice the number that will be shakily and prematurely old in a few years.

The house should be built so as to admit of good ventilation and a free circulation of air in hot weather, and so arranged that the sun will shine into every room at some time during the day. The living rooms should be large and the dining-room and kitchen arranged with special reference to economy of strength and time. A flight of steps leading up to the front door is allowable, but at the rear the grading should be such that a single step will reach from the ground to the floor, and if possible the wood and water should be on a level with the kitchen. The living room, which will be used most in winter, should always have a southern front. A bay window adds greatly to the cheerfulness of a sitting-room and is very desirable. The arrangements in the kitchen and dining-room should be with reference to saving steps, and the relative position of stove, cistern, cupboard, pantry and cellar stairs carefully considered. A dumb-waiter from the cellar to the dining-room, or to come up between the dining-room and pantry, so as to be accessible from both, will save many trips to the cellar, and much heavy work in carrying milk, cream, etc., up and down stairs. Screens for

the doors and windows are a cheap luxury, and should be found in every farm house.

There are many little conveniences which add to the comfort and save labor. A bracket lamp with a hinged stem, and a reflector on a pivot, will enable the light to be thrown on any point in the room, and is of especial value in the kitchen, as in the winter much of the cooking must be done by lamp light, and it is neither safe nor convenient to have a lamp near the stove. Often the location of a cupboard can be changed so as to save two or more steps each trip, and when we count the trips for a single day, and multiply by the days in a year and the years in a life-time, we begin to get some conception of the



FIG. 1.—ELEVATION OF FARM COTTAGE.

importance of saving a step. The location of a door or the cellar stairs should be such as to reach the desired point in the easiest and shortest possible way. The stairway should be wide, with broad steps and easy grade, without crooks or turns.

We give plans of cottage and farm house, which may be of value to those intending to build, even though they may not adopt them.

The design of a farm cottage (Fig. 1, page 383) will meet the wants of many who wish to build at a moderate expense.

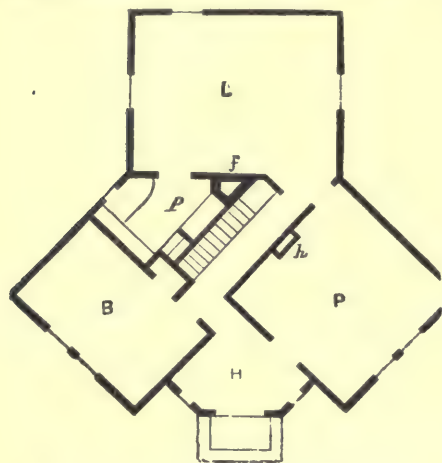


FIG. 2.—GROUND PLAN OF FARM COTTAGE.

H, Hall. P, Parlor. B, Bedroom. L, Kitchen or Living Room. P, Pantry. H, Chimney. Low bedrooms can be finished off above.

The style and finish can be varied to suit the taste and means of the owner. From the hall you can reach all the rooms on the ground floor, and the arrangement of the house gives the sun access to every room.

A Convenient Farm House.—Our illustrations 3, 4, and 5 show the elevation, ground and second floor, of a roomy and convenient farm house. It is so arranged that the sun shines into

each room in the course of the day. The hall is entered from the front piazza, and this hall gives access to the principal rooms below, and by an easy flight of stairs to the sleeping apartments above. The parlor has an octagonal bay-window and a fire-place opposite. The kitchen has both doors and windows on opposite sides.

The Door Yard.—It is useless to attempt to lay down a set of rules for laying out or management of the grounds about a farm dwelling. The size of yard, location, and style of house, slope of the land, means of the owner, and many other questions must be understood before one can give intelligent advice in the matter. Some hints, however, can be given, which may prove of value to those with little experience. One common error to be avoided is crowding too much into the grounds. The wife is likely to want a plant of every handsome rose or flowering shrub she sees, and they are set out here and there, wherever there is a vacant space, and grow and spread till a tangled thicket is formed, inaccessible to scythe or hoe, and in which noxious weeds get a foothold, from which they spread and gain possession of the yard.

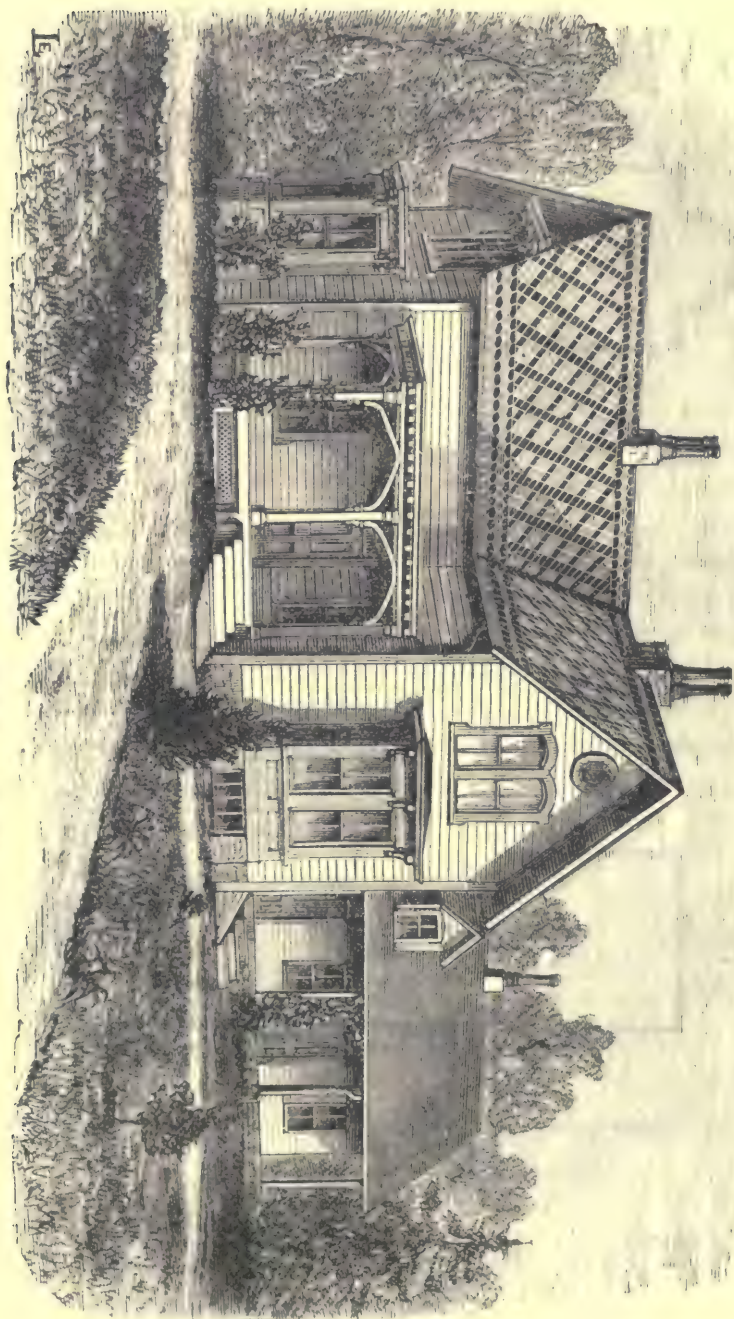


FIG. 3.—A CONVENIENT FARM HOUSE.

Another common mistake is in planting trees too close to the house. It is difficult to realize when setting an evergreen no larger than a currant bush, or an elm-tree the size of a bean

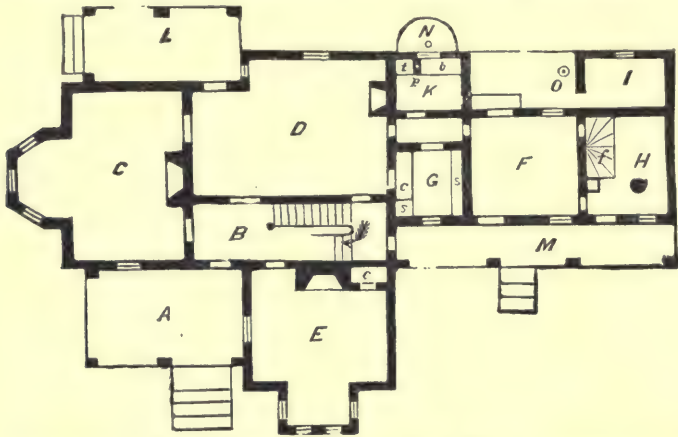


FIG. 4.—GROUND PLAN OF FARM HOUSE.

A, Front Veranda, 10 x 16. B, Hall, 7 x 20. C, Parlor, 12 x 18, with bay-window, 4 x 6. D, Dining-room, 15 x 20. E, Library, 12 x 15, with square bay-window, 4 x 8. F, Kitchen, 11 x 12. G, Pantry, 8 x 8. H, Store-room, 10 x 12. I, Coal-room, 7½ x 8. K, Wash-room, 7 x 8. L, Veranda, 8 x 16. M, Veranda, 4 x 30. N, Cistern, 9 feet diameter. O, Well. c, c, Closets. s, s, Shelves. b, Bath. f, Back stairs. t, Sink. p, Pump.

pole, that in a few years they will develop into stately trees. A tree that is to remain permanently in a door yard should never be planted nearer than thirty feet from the house. It is

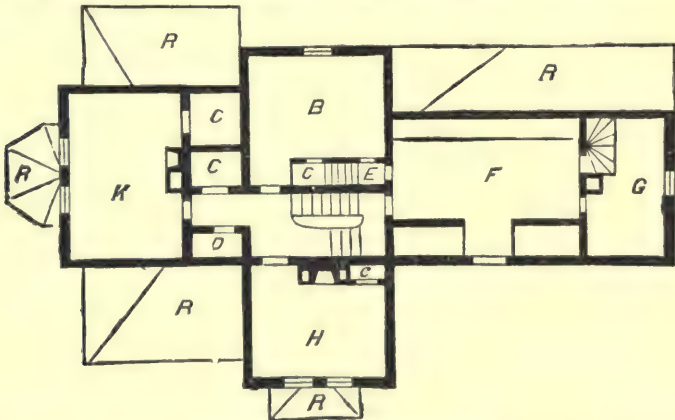


FIG. 5.—PLAN OF UPPER FLOOR

Hall, 7 feet wide. C, C, C, C, Closets. D, Linen Closets. E, Attic Stairs. F, Servant's Bedroom, 11 x 20. G, Garret. B, Bedroom, 15 x 15. H, Bedroom, 12 x 15. K, Bedroom, 12 x 18. The upper hall is lighted by a window.

often advisable to plant some rapidly growing trees nearer than this to furnish a temporary shade while those at a distance

are growing; but they should be removed as soon as they can be spared.

For a temporary shade there is no better tree than the soft maple, as it has a dense foliage and makes a rapid growth. If trees of this variety three inches in diameter are carefully transplanted and well cultivated, they will afford a fine shade in three years. I planted a group of these trees in the spring of 1877, grown from seed planted in 1871, and in August of 1883 the largest one, three feet from the ground, measured twenty-five inches in circumference, and several others were nearly as large. The objection to this tree for permanent shade is that the wood is so soft that it is liable to be broken by winds which would do no damage to many others. It is also subject to a bursting of the bark on the south-west side, caused probably by the sun shining on it when frozen, and it is rare to find a tree with a smooth, perfect trunk. These imperfections make it more liable to be broken by the wind. The trees which I prefer to all others for shade are the elm, hard maple, and ash. I put the elm first on account of its rapid growth, its elasticity and toughness, and its grace and beauty of contour. One need not fear the loss of his elm trees by any ordinary wind, for nothing short of a hurricane will injure them. The hard maple is worthy of a place in every farm yard, as it is unsurpassed in the beauty of its autumn foliage, and possesses also the merits of durability, compactness, symmetry of shape, and density of foliage. The ash possesses all the good qualities of the maple, and as its prevailing autumn color is yellow, it forms a fine contrast with the scarlet of the maples. The catalpa and linden are also valuable trees for shade, and when in bloom present a beautiful appearance.

Where the grounds are large enough to allow of it, there is nothing gives a better effect than a small forest planted in imitation of nature. This forest may be made up of the varieties above named, or it may contain specimens of all the varieties which grow in the locality.

I would never plant evergreens in the front yard or near the house. The only use for which I would recommend them is for wind-breaks and screens, planted at some distance from the

house. One great objection to the conifers is that they keep the yard littered the entire year by the falling cones, and the most beautiful varieties are the worst in this respect. The Scotch pine is one of our most beautiful evergreens, always keeping a good shape and retaining its color perfectly the entire year; but the cones are a perennial nuisance. This and the American spruce I would plant in clumps or thick rows, not less than one hundred feet from the house to the north and west. For an evergreen hedge I would use the red cedar, or American arbor vitæ. Either will bear close trimming, and can be made ornamental and valuable as a protection.

To secure rapid growth of shade-trees, thorough culture for the first few years is absolutely essential. I planted in 1877 a group of about thirty forest trees, half of which were set in what had been a flower garden and the balance in a blue-grass sod. The ground in the first-named part was cultivated more or less for the next five years, and there the trees have made a wonderful growth, and in three years were giving a good shade. On the sod the growth has scarcely been perceptible, and after seven years they afford but little shade. I have had the same experience with elm-trees planted in my door yard. A fine, thrifty tree planted in the sod stood ten years before it was large enough to afford valuable shade, while another planted ten years later and cultivated is likely to outstrip the first in growth.

If you wish a newly planted tree to grow rapidly, attend personally to the transplanting. See that it is taken up with as little mutilation of roots as possible, that it is planted in good soil well mellowed, and that for three or four years a circle around it not less than eight feet in diameter be kept clean and mellow by cultivation or mulch. If in grading the surface soil has been removed, it will pay to draw a load of good soil to put in the hole to give the tree a start. Forest trees will grow on almost any soil after they get a start and do not need coddling; but where shade is wanted soon, it will pay to be at some trouble and expense to give them the start needed.

In no other way at so little expense and labor can the surroundings of a house be made beautiful as by planting trees. In

almost any neighborhood choice trees can be had for the digging, and after they are three or four years planted no labor will be required. That yard is beautiful that has a sufficiency of good shade trees and a well-kept lawn, and can be kept so with very little expense.

The Lawn.—The first point requiring attention in making a lawn is grading. In a majority of cases, in order to save what grass there is, and to avoid the temporary inconvenience of a fresh plowed yard, grading is neglected and the ground left with bumps and hollows. In all cases where old door-yards are in this condition, I would recommend that they be plowed, graded, and re-seeded. Early spring is the best time for this work, because it saves the annoyance of a bare yard, and the mud which will be troublesome all winter. A yard graded the latter part of March, or early April, and properly seeded, will in four weeks present a good appearance, and by midsummer have a fair turf. The grading must be governed by the elevation of the house and the natural slope of the land. It should be such that there will be no depressions to hold water. The front yard should be nearly level, if the land admits of it, and the slope uniform from the point where it begins to the lowest part.

To make this matter plain we will suppose that the house stands fifty feet from the road, and that the door-yard is two hundred feet wide. The first floor of the house three feet above the level of the yard and six feet above the lowest point where the outlet for the surface water will be. In this case I would grade the front yard so as to give a fall of six inches from the front door to the road which would be ample to carry off the water. For twenty feet on each side of the house I would maintain the same grade, and then would, from this point, increase the grade to that necessary to make it uniform to the lowest point. If in grading you are obliged to make fills of a foot or more at some points, it will be necessary to wait a week or two after the fill is made to allow it to settle, and then re-grade, or else the fills will settle and leave your grade imperfect. If you cut down to the subsoil in places, you should save

some of the best earth to cover these spots with, so that the grass may make a uniform growth. It will pay also to dress the surface liberally with fine manure, or with bone meal at the rate of four hundred pounds to the acre.

After the land has settled, and every depression been filled so that the grade is just right, harrow the surface fine, sow your grass seed and cover it lightly by dragging with a light plank drag. Most writers recommend a mixture of several kinds of grasses for the lawn, but I would sow only timothy and blue-grass, and with it a little oats. I would sow at the rate of two bushels of blue-grass and half a bushel of timothy and two bushels of oats to the acre. The oats will cover the ground in three or four weeks so as to relieve the bare look, and will shade and protect the young grass. Just as soon as it is high enough so that a scythe will cut it, it should be mown, and once every ten days or two weeks afterward. By the middle of June your yard will look well, and before fall there will be a good turf. It will pay to do this work of grading and seeding thoroughly for when once done it is done for a life-time. A lawn can be kept in better condition with a lawn mower than a scythe, but on a smooth grade a sharp scythe will do good work.

Shrubs and Flowers.—Whether shrubbery does or does not add to the beauty of a door-yard depends entirely on its management. I believe that in a majority of cases it detracts from rather than adds to it. I would advise, first, that no shrubbery be planted in front of the house; second, that no part of the grounds be crowded, and, third, that as a rule all shrubs be in groups in cultivated beds. All that should be allowed in the front yard, beside shade trees and grass, is a border of flowers along the walk. There are a few shrubs that may stand singly—for example, the lilac, snow-ball, and japonica—but each should have a circle around it, spaded and kept clear of grass and weeds. Most varieties of roses and other shrubs should be grown in groups, and a much better effect will be produced by a rose garden containing one or two square rods, and kept trimmed and spaded, than by a dozen or more roses scattered here and there, struggling with the grass.

Unless a gardener is to be kept to attend to the yard (which is rarely the case on the farm), very few shrubs and vines should be planted. For the climbing roses, honeysuckles, clematis, etc., a rustic trellis made of lasting wood like the locust or osage orange is preferable to any fancy work, for the beauty should be in the vines, not the trellis, and the less conspicuous the latter is the better. Most varieties of flowers give the best effect when grown in masses, and it is best to set apart a suitable place in the yard for a flower garden rather than cut up the lawn with little beds made in fancy shapes.

I will name a few varieties of flowers of easy cultivation which will continue long in bloom and give good satisfaction. Of annuals we have Pansies, Petunias, Verbenas, Phlox Drummondii, Salvia-splendens, Portulacca, Scabiosa, and Dwarf Nasturtium. Most of these continue long in bloom, and there will be an abundance of flowers from June till November. For climbers the balloon vine, Sweet Pea, Clematis, and Cypress, will furnish delicacy of foliage, beauty, and fragrance. A bed of Geraniums will give a fine show, both of foliage and blossoms. The plants named above, if well arranged, will be sufficient to ornament any door-yard, will furnish fine flowers for cutting, and give a succession of bloom for the summer and autumn. Many others can be used to advantage if desired, and there is time to attend to them properly. Foliage plants, such as the Euphorbia and Ricinus, and the various Amaranthus, Celosia, Antirrhinum, Zinnias, and Dahlias, are of easy cultivation.

Fences and Walks.—Fences, as far as possible, should be conspicuous by their absence, and where imperatively necessary should be given as little prominence as possible. I would never build a paling fence near a dwelling and would not fence off a front yard by itself, neither would I paint a fence white. Let the fences at the sides of the yard be hidden by a grape trellis or evergreen hedge, and at the rear let it stand well back out of sight. For the front fence, a close trimmed hedge is, perhaps, best, but if a fence must be built, make it low and paint a neutral color. A plain board fence, with one board a foot wide at

the bottom, and three four-inch boards above, and capped, makes a much better fence for a farm-house than palings.

The walk leading to the front door must be suited to the size of the yard and surroundings. It should rarely, if ever, be straight, but should be semicircular or serpentine. When the house is at such a distance from the road that a true half circle, will reach the front fence at the right points of exit, and the center come to the front door, the semicircular walk looks well. If the drive-way is located at the proper distance, one end of the walk can terminate there. A neat stile, with easy, broad steps is often better than a gate. The walks at the rear of the house should be made for utility, and should usually be the shortest distance between the points connected by them. They may be paved with stone or brick, or made of plank, gravel, or spent tan-bark. Where good gravel can be had a permanent substantial walk can be easily and cheaply made, and it will be greatly improved by a light dressing of tan-bark each fall.

To make a good walk there must be such grading as will give perfect surface drainage. I would throw up a walk not less than six feet wide, with the center a foot above the ditches at the sides. Then cover with coarse gravel or a single layer of flat stone, and above this a coat of fine gravel. The advantage of tan bark is, that it does not get sloppy and track into the house during a thaw as gravel does.

The best way to make a plank walk is probably to place 2x4 scantling on edge the distance apart that the width of the walk is to be, and nail short boards across from one to the other. A very neat and serviceable walk two feet wide can be made in this way for about one dollar a rod.

The out-buildings should be conveniently located. The wood-shed should be large enough to hold a winter's supply of wood, and should be convenient to the house. The privy should be hidden by a clump of evergreens or a vine-covered trellis, and should have instead of a vault a shallow wooden box, so arranged as to be easy of access. This box should be made water-tight and placed on the top of the ground, and there should be a hinged door at the rear of the privy which will give

easy access to it. There should also be a shed, or large box covered so as to exclude rain, in which a wagon load of dry earth can be stored, and two or three times a week enough of this should be shoveled into the box to absorb all moisture. Managed in this way a privy can be kept odorless with no danger of contamination of water or air, and a large amount of valuable fertilizer made from it during the year. It will take but a few hours' labor in a year to attend properly to this, and by so doing, what is usually a most disgusting nuisance, and often a cause of disease, will be rendered inoffensive.

Other out-buildings such as piggeries, poultry house, carriage house, etc., should be located so as to offend neither eye nor nose. On many farms the out-buildings have no order or arrangement, but are dumped down here and there without regard to appearance or convenience of access. It is easy to save steps and avoid this helter-skelter arrangement by a little planning.

There is one point which concerns the health of the family which can not be impressed too strongly, and that is the care necessary to insure pure drinking water. Disease is no longer looked upon as a mysterious dispensation of Providence, but as a penalty for the violation of nature's laws, and contaminated water is a fruitful source of disease. A well located near the house in a soil which fills it with water to the surface, can not afford pure, safe drinking water. There are large sections of country where the land is rich and every thing favorable except the water supply, and the wells which are flooded to the surface during wet seasons, get low during a drought, and cause fevers and diseases of the stomach and bowels. It is often very difficult to construct cisterns in these soils, as the pressure of the water from without breaks the cement and they become flooded like the wells. An experienced cistern-builder tells me that one *can* be made that will exclude the water in the most spouty soils. A brick wall should be made an inch or two from the sides of the cistern and plastered on the outside as it is laid up, and then this space filled with a grout of cement, poured in so that it will fill all the interstices. When this becomes solid and

the wall is plastered inside it will defy all water from without. A cistern filled with rain water during winter will furnish safe, pure water for summer use.

Too much care can not be taken in the disposition of the slops from the kitchen and chambers. I would not risk a sink drain, as there is great danger of contamination and disease from it, and there is a better way to dispose of this waste. As near the house as it can be done put up a small shed roof, under which put a wagon load or two of dry earth, and empty the slops on it. Keep a shovel in the shed and each time you empty a pail of the slops shovel some dry earth over it. This shed may be an enlargement of the one recommended for the privy. Chamber slops disposed of in this way will never be offensive, and in the course of a year a large amount of valuable fertilizers will be made. These slops can never, with safety, be thrown on the ground around the house.

CHAPTER XVI.

SMALL FARMS FOR POOR MEN.

THERE is in every community a large class of men whose tastes would lead them to become tillers of the soil, but who are deterred from attempting it because they have not the capital to buy and stock a farm of fifty or one hundred acres, which they imagine would be necessary for the support of their families.

France is one of the best cultivated and most prosperous countries on the globe, and its prosperity is largely due to the fact that it abounds in small farms of from one to five acres. If, as I believe, a very few acres can be so managed as to give a comfortable support to a family, it is clearly within the scope of this book to show how it can be done.

The tendency of the age in nearly all callings is for capital to combine, and form great corporations, so that the mechanic no longer works for an individual who may have a feeling of interest in and some compassion for him, but for a soulless corporation, whose only interest in him is to get his labor for the smallest possible sum that will keep his family from the poor-house. To counteract this "trades unions," and various forms of labor combinations have been formed, and the laborer who belongs to one of these must stop work whenever a strike is ordered, even if he has no money to support his family. If he stands aloof from the labor organizations he is denominated a "scab," and is often subjected to petty persecution, or, if he attempts to take the place of a striking workman, to bodily injury. The dishonesty or reckless speculation of a single member of the corporation, or some unforeseen and unavoidable financial disaster, may, and often does throw thousands of laborers out of employment,

perhaps at the beginning of winter, when family expenses are largely increased, and untold suffering results. Under these circumstances those who depend on their labor for the support of their families are too often ground to powder between the "upper and nether millstones."

Another matter of deep interest to parents is the influences which surround their children during their early years, when they are forming the habits which will go with them through life and largely affect their future destiny. In this respect the man who owns a few acres of land has a great advantage over the laborer who must live in a tenement house. In the latter case there are no pleasant local associations connected with childhood. The parents can not choose the associates for their children, as the man who has no income but his daily wages and must buy all that his family uses can not afford to be very particular about his location, and cheap rent must necessarily be considered first, and not unfrequently he moves every year or oftener. Still another evil. There is no work suited to the capacity of his children during their earlier years, and when not in school they are idle, and so much more likely to form bad associations and acquire bad habits.

The condition of the man who owns a few acres of land and knows how to cultivate them when contrasted with that of the laborer seems to me to be enviable. He owns the soil which he cultivates, and feels that he is independent. He pays no rent, and though his home is humble, it is his own, and he is stimulated to improve it. As soon as his children are old enough to follow him, there is something for them to do suited to their capacity, and they early acquire habits of industry. During a large part of the year every day in which good wages can not be earned elsewhere can be profitably employed on his land, and often all his time, summer and winter, can be put in at home. He may not handle as many dollars in a year as he would if he worked for wages; but the saving in rent, and the family supplies which his land furnishes, will make it far more likely that he will have something laid up at the end of the year. He will be able to control the associates and form the habits of his

children to a much greater extent than if working out as a laborer.

There is still another side to this question, and that is the advantage to the community in having honest, industrious neighbors, ready to help in the many emergencies which arise on the farm. The farmer is often obliged to keep a hired man, thus adding to the work and burden of his wife, often when she is already overtaxed, which he could dispense with had he a neighbor on whose services he could rely when extra help was needed. The man with one or two acres of land could work out the larger part of his time; but with from five to ten acres he could employ the most or all of his time at home.

How to get a Home.—If a laboring man must wait till he has saved money to pay for his land, he will stand a poor chance of ever owning it. His best plan is to buy on long time, and apply the money which would be paid out for rent toward paying for the place. Fortunately, in most of our States building associations have been organized to meet such cases as this, and wherever one is accessible it makes it an easy matter for a man with any enterprise to secure a home.

These building associations issue stock to be paid in small weekly installments. In all that I am familiar with, the shares of stock are two hundred dollars and the weekly installments twenty-five cents a share. This gives eight hundred weeks or over fifteen years in which to pay up his stock. Any one can own stock in the association; but no one can borrow out money except a member of the association who owns real estate, and the loan is secured by first mortgage. Any member who has not borrowed can withdraw his money and have his stock canceled at any time, but must wait till the end of the year or lose his dividends, which are declared annually. If the stockholder has the money to spare, and wishes to save the trouble of weekly payments, he may pay monthly, semi-annually, or annually in advance, and when he pays six months or more in advance, he is allowed interest at the rate of six per cent on the money so paid. A fine of five cents per share of stock is imposed each week in default of payment of dues. At the end of

each year a dividend is struck, and the profits are divided *pro rata* among the members.

The association is governed by a board of directors chosen from the stockholders, who serve without pay, and the only salaried officer is the secretary, who keeps the books. The money accumulating from dues and interest is put up at auction and sold to the highest bidder, the amount bid being the premium above six per cent. For example, if a stockholder at a sale of money should bid one cent and the money is knocked down to him, he will pay seven per cent interest on the money advanced to him until all his stock is paid up and canceled. To do this, he can take the full time of eight hundred weeks from the date of his stock, or at any time when he can get the money he can pay it off and have his stock and mortgage canceled.

Each association has an attorney, whose business it is to see that the property offered for security for the loan is free from incumbrance and to draw the necessary writings, and for this service a moderate fee is fixed by the association and paid by the borrower. The attorney also sees that the buildings are insured. When any one borrows money from the association, a committee of members is appointed to examine the property and report if it is ample security for the amount wanted on it, and the attorney at once examines the record to see that the title is clear.

We will suppose that a man finds a piece of property which will make him a home, which he can buy for \$600.00. His payment of dues would be 75 cents a week on this amount of money, or \$39.00 a year. His interest the first year will be on the \$600.00, and at seven per cent would amount to \$42.00; but the next year he will only pay interest on \$561.00, and so his interest will be reduced each year until it will finally cease when the principal is all paid. There are many localities where small tracts of land can be bought at from \$50.00 to \$100.00 per acre and often for less, where a man could buy from two to six acres and build a comfortable house on it, and his annual payments would not greatly exceed what he pays for rent for a

bare house to live in, and in the latter case there is no need of moving every year, for he has a home of his own, which he can improve and adorn. To be in debt a small amount for the purpose of paying for a home ought to stimulate a man to be industrious and economical, and be of great advantage to him.

How to Manage a Small Farm.—With a few acres of land secured for a home, the next question is how to make the best use of it. No set of rules can be laid down for the guidance of all, for the location and surroundings must determine this largely. It is safe to advise, however, that as far as it can be profitably done, the family supplies be home-grown. All the potatoes, beans, beets, squashes, tomatoes, and other vegetables needed in the family, can by thorough cultivation, be grown on a very small piece of land. If there are two acres or more of land, I should advise that a cow be kept, and with a farm of ten acres it might be profitable to keep several. These cows should be kept in the stable, and green crops grown for soiling. A small lot should be provided, in which they could be turned for a short time each day for exercise.

If the amount of land will admit, an acre or two of wheat should be grown to supply the family with flour, and a small plot of corn would fatten the pigs for the family meat, and furnish fodder and corn for the cows through the winter. This much or more could be done on a few acres, and very little time taken from other work; and a mechanic who works on the ten hour system could put in full time at his trade, and by hiring an occasional day's work, get a large part of his family supplies from his little farm.

In other cases it would pay the man to put in all his time on a few acres, and his study would be, not how can I get along with the least work, but how can I profitably employ my entire time? There are many ways of getting an income from a few acres that the industrious, thoughtful man will discover. A fair income can be derived from poultry, by any one with a taste for the business, and the necessary carefulness and patience to attend to it properly. This could be carried on without taking much time, as the wife or children could look after them if the

man would provide coops and do the heavier jobs. Just as heavy crops of potatoes, corn, and most other products could be grown if the fowls were allowed to run at large, and by having a small lot to confine them in for a part of the year, they can be kept from damaging other crops.

It would not be difficult, by soiling, to keep six cows on ten acres, and where the milk could be sold at retail, this would give a fair income; or if a fine quality of butter was made, that would sell at a fancy price, this and the pork made from feeding the skim-milk to pigs, would amount to a good sum. Still, another man might prefer to cultivate his land in broom-corn and manufacture the crop in winter, and would find this profitable. Those who have a taste for gardening and small fruit growing, and who are so located as to be convenient to a good market, and what is more important, to a good supply of manure, will find that from five to ten acres will furnish employment for one or more additional hands, and give a handsome income.

In every neighborhood one or more persons can net a handsome sum by growing, for sale, plants of cabbage, tomato, sweet-potato, pepper, etc., and this will require but a few square rods of ground. Examples might be quoted without number of men who have supported their families, and even acquired a competency from a few acres in garden.

In 1875 I hired a young German for one year. He had landed penniless. He earned during the year one hundred and eighty-six dollars, nearly all of which he saved. The following spring he rented four acres of good garden land, put what money he had into sash, manure, and tools, got credit for his garden seeds, and went to work. He has bought the land.

I clip from an agricultural paper the following account of the success of a house-carpenter who settled on a bit of land, less than three acres, in New Jersey. He expected to have a garden and depend on his trade for support, but times were dull and wages dropped, and the outlook became dismal. He determined to go to work on his land and see if he could not make a dollar a day from it. The sequel is told in his own words.

“Some of my neighbors said it would be a failure—farming

did not pay. Many who had ten to twelve acres left it to grow up to brush and weeds, and took their departure. I had buried my money here and I was going to dig for it. I dug stumps, raked roots, and grubbed until I got the land in pretty fair condition. Then I dressed it well with fertilizers, put out the best varieties of fruit, gave them the best of care, and I soon began to realize what I have often heard repeated: a little farm well tilled; a little home well filled; a little wife well willed; then you are on the road to prosperity. My efforts were crowned with success. I was not long in realizing my dollar a day, with an increase as the condition of my land improved, until the past season I turned off from my little 2 85-100 acres over five hundred dollars worth of fruit, vegetables, and seeds besides keeping from one quarter to one third in grass. I will give you some of the items:

10,000 young onions.....	\$25.00
Spinach and pie-plant.....	8.00
Plants, various kinds.....	15.00
112 bushels of strawberries.....	358.40
300 quarts raspberries.....	25.00
275 quarts currants.....	22.00
15 bushels early potatoes.....	20.00
20 bushels pears.....	25.00
5 bushels onion sets.....	20.00
Other fruits.....	5.00
25 pounds sage.....	12.50
15 pounds turnip seed.....	15.00
4 pounds sage seed.....	10.00

"Besides the above, not extended in figures, we have canned fruit, etc.: 100 one-quart cans pears; 12 do. strawberries, 12 do. crab-apples; 10 quarts pear jelly; 10 quarts crab-apple jelly."

No doubt larger sums have been realized from garden crops in many instances, but it is not the purpose in this chapter to enumerate them, or to give details of management. The reader will find suggestions which will be of value in managing a small farm in the chapter on Poultry, Soiling, Gardening, etc.

Even if only ordinary farm crops are grown on the small farm, it will be found profitable to own a few acres of land, and

in a large majority of cases no doubt it would be best to grow these crops. I know a man with but four acres, who has made wheat his leading crop for years, and has excelled all his neighbors in yield. His little wheat field has not taken much of his time, and the manure made from the straw used as bedding for his cow and pigs, and the dropping from the poultry have enabled him to keep his land in high condition, so that his crops have been uniformly profitable. With but a few acres of land to cultivate, the owner could do the work thoroughly and at the right time, and can, in consequence, expect better crops than his neighbor, who has a large area to go over. The tendency to large farms is not, I believe, conducive to the good of the nation or the best interests of society, and I should rejoice to see small farms multiplied.

CHAPTER XVII.

HANDY THINGS ABOUT THE FARM.

LIFE is made up of little things, and our comfort often depends largely on the little conveniences found around our homes. Some farms abound in them, while on others they are conspicuous by their absence. It is proposed in this chapter to illustrate and briefly describe quite a number of cheap and convenient articles, most of which can be made by the farmer himself with saw and hatchet, and any of which can be made by the blacksmith or carpenter. While no one farmer will be likely to use all of these, it is believed that all will find in this chapter many things so valuable and cheap that they will adopt them.

On perhaps a majority of farms no lifting-jack of any kind is to be found, but the farmer when he wishes to grease his wagon axles, hunts for a rail and board, and often after spending more time in hunting than should be required to do the job, only succeeds in getting a crooked or rotten rail and a board either too long or too short.

Fig. 1 shows the cheapest substitute for a jack.

It has the merit of being always ready for use, and the upright swings into place of itself, leaving both hands free to lift with. Pins or cleats on the lever prevent the axle from slipping.

The illustration (Fig. 2) shows a jack that has given good

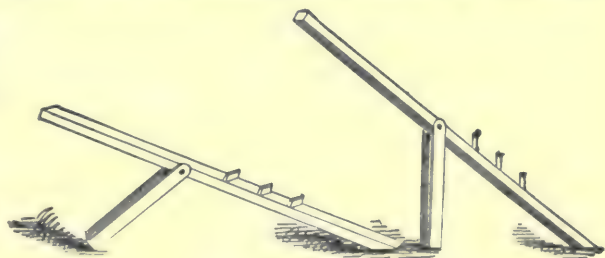


FIG. 1.—WAGON-JACK.

satisfaction for many years. It is light, easily handled, and does not shove in lifting. It should be made of tough, hard wood, and is best planed and painted. The base, *a*, should be

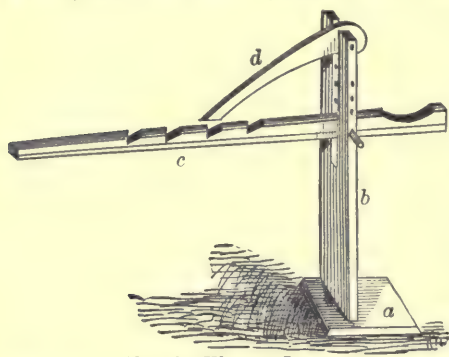


FIG. 2.—WAGON-JACK.

of two-inch plank, 8 x 14 inches, the upright, *b*, 3 x 4 inches and two and one-half feet high. The lever, *c*, should be of one and one-half inch stuff, five feet long and three inches wide at the short end, but may taper to two inches at the handle. There

should be several holes for the bolt, to accommodate different heights of axle, and it should fit loosely. The bolt should have a hole or slot in the end opposite the head, so that a leather key can be drawn in to prevent it from falling out when carrying the jack. The ratchet, *d*, should be so shaped and hung as to work readily in the notches on the lever.

Fig. 3 shows one of the simplest and best wagon-jacks I have ever seen. The base should be of 4x4 scantling, eighteen inches long; the upright 3x4 inches and twenty-six inches high; the lever one and a half inches thick. The ratchet, which is of wrought iron, is hung by a single bolt to the lever, and a handle is bent back over the lever, so that when you wish to lower the wheel you grasp both the lever and ratchet handles. When you wish to raise it, however, you grasp only the lever, and the ratchet plays in the staple and catches of itself.

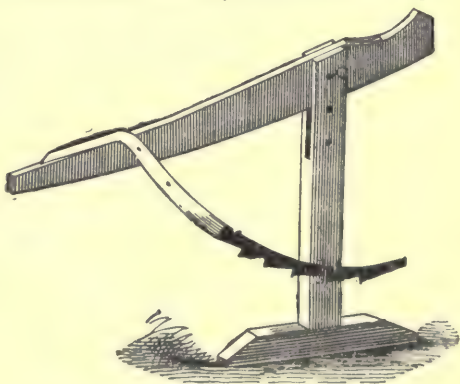


FIG. 3.—WAGON-JACK.

This jack (Fig 4) will be found convenient in handling heavy hogs, as it can be swung round in any direction, combining the properties of a crane and a hoisting machine. The upright

should be six inches square and two feet long, and the legs mortised in firmly. The head in which the lever works should be secured by a strong iron pin, which acts as a pivot, and at the end of the lever should be a swivel hook with a sharp point. The lever should be sixteen feet long, and may have several holes in it, so as to give more or less power as needed.

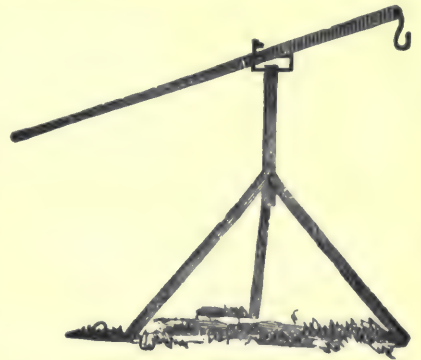


FIG. 4.—A HOG JACK.

Fig. 5 shows a cheap and simple contrivance for hanging up hogs. It consists of three poles or scantling eight feet long, bolted together at the top so that they can be raised or lowered. Hooks should be driven into the front of the two outside pieces on which to hang the hog. These are so easily made that it will pay to have one for each hog.

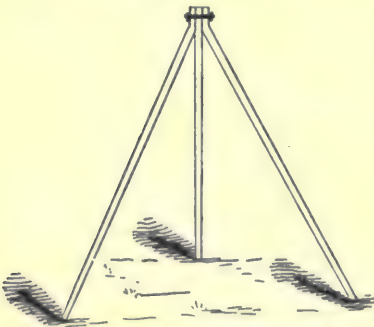


FIG. 5.—HANGING RACK FOR HOGS.

With the improvement in cross-cut saws, and the growing scarcity of timber, the ax is used less and the saw more than formerly in cutting wood. It is hard on the back to saw a log flat on the ground, and the saw is likely to be dulled, and also to have the set taken out of it by pinching. By the use of the handy log-holder shown in the cut on the following page (Fig. 7), two men can easily roll up a

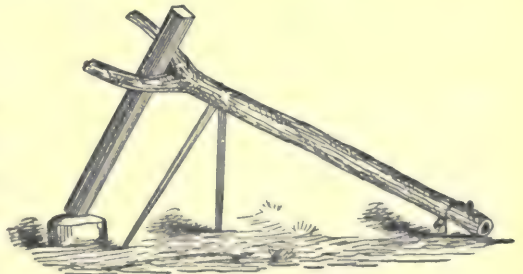


FIG. 6.—POST-HOLDER.

large log. It can be made of round poles, and the legs should be about twenty inches long, the other ends resting on the ground. Several holes should be bored in the poles so that the log can be held at any desired spot.

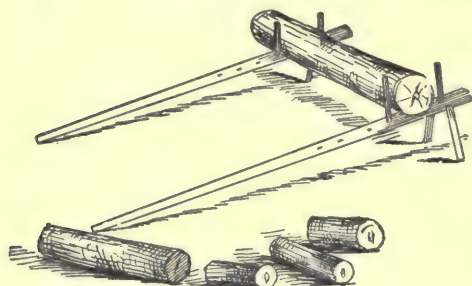


FIG. 7.—LOG-HOLDER.

Fig. 8 is a device for raising logs, by means of which one man can lift a heavy log. The standard is made of two strong plank, 2x6 inches, and 7 feet long. Cleats are put between them at the ends, and it is securely bolted together. The leg, or support, is fastened with a bolt, so that it can be raised or lowered at pleasure. Two rows of holes are bored in the standard to receive the pins, and the lever has a notch to fit them. In working the machine the pins are alternately moved up a hole at a time.

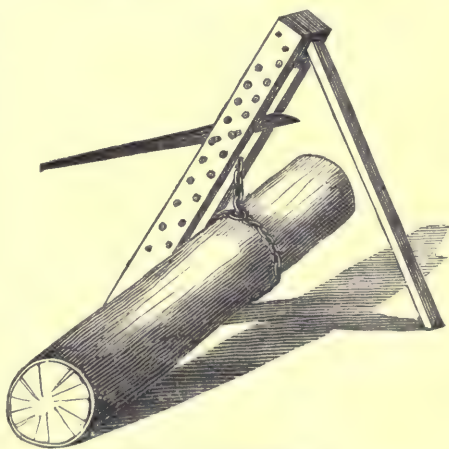


FIG. 8.—LOG-LIFTER.

Any one who has tried to split stove-wood, knows how difficult it often is to hold the stick in such a position as to enable one to strike it to the best advantage. A very few minutes work will prepare a holder like that shown in Fig. 9.

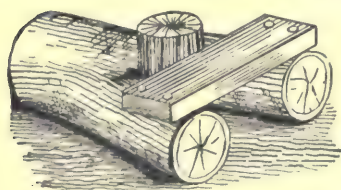


FIG. 9.—WOOD-HOLDER.

On our heavy clay soils posts can be driven into the ground so as to stand quite firmly, if the work is done just after the frost comes out in the spring. Where posts are set in holes, it is a great saving of labor to drive a stake for the middle of the panel. The device shown in Fig. 10 is a very convenient platform on which to stand while

driving the posts. As two hands are usually required for this work, this platform would be cheaper and just about as valuable if made without wheels, and handles instead on both sides.

Mr. John M. Jameson, of Ross County, Ohio, sends me a description of a 20-foot hay gatherer (Fig. 11), which he has used for several years to great advantage. With it the hay is taken from the ground and delivered

at the stack without any pitching or handling. Mr. Jameson describes its construction as follows: The head should be 5x6 inches, and 20 feet long. The teeth split from tough, straight timber, six feet long and two inches in diameter at the head, and tapered somewhat to the point. They should be sharp and sloped on the under side. The corners of head piece should be rounded on the lower side to enable it to slip over the stubble with little friction. A clevis should be attached to each end, so arranged that it will turn round the end when you wish to draw the rake backward. When going out from the stack for a load, the rake is drawn backward. The chains to which the horses are attached should be seven feet long to enable them to keep out of the way of the teeth. Mr. Jameson found that no up-rights in the head were necessary to keep the hay from sliding over the rake. He first put on up-rights, but the rake was soon turned over and the up-rights broken off, and he then found that it worked as well without them. Hay gathered in this way will have less dust than when raked with the sulky-rake.

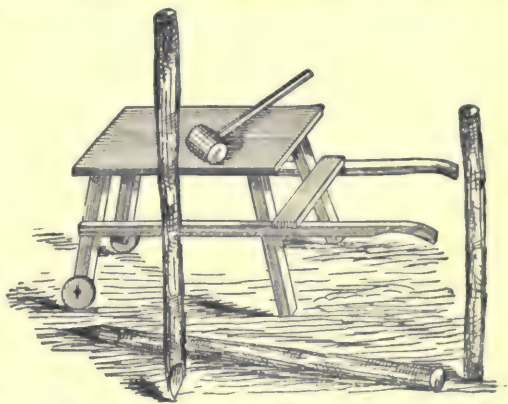


FIG. 10.—PLATFORM FOR FENCE BUILDING.

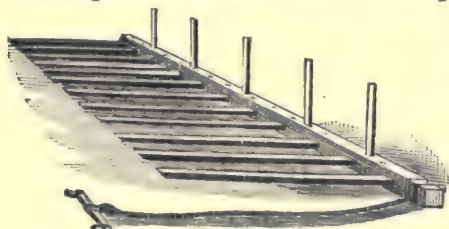


FIG. 11.—HAY GATHERER.

The practice of cutting up corn is becoming more common each year, as farmers learn the value of corn fodder. It is tiresome work to husk all day on one's knees, or with the back bent. A husking table, as shown in Fig. 12, will keep the fodder from the dirt, and enable the husker to stand up to work. It is, also, more convenient to bind the fodder on the table than the ground. It should be made strong and well braced, but of light material.

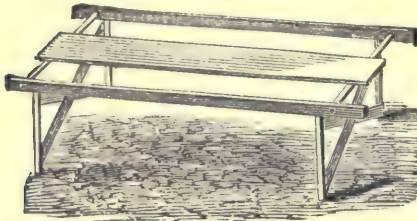


FIG. 12.—HUSKING TABLE.

It is often necessary for some one to go alone to the field to bring in a load of shock corn, and any one who has tried it knows how difficult it is to load. Fig. 13 shows how to arrange a ladder up which a man can easily walk with his arms full of corn fodder. It is merely a plank, two inches thick, a foot wide and ten or twelve feet long, attached by ropes or chains to the rear end of the wagon.



FIG. 13.—LADDER FOR LOADING FODDER.

Fig. 14 shows a cheap corn horse. It is often desirable to cut off the corn and seed the shock row before setting up the shocks. This can be done by the use of the "horse." The pin should fit loosely, and be long enough so that it can be easily drawn out after the shock is set up, when the horse can be drawn forward to where the next shock is wanted and the pin put back.



FIG. 14.—SHOCKING-HORSE.

Fig. 15 illustrates a simple device for pulling straw out of a stack. Go to the woods and cut a limb five or six feet long with a branch near the large end, which must be cut off and sharpened, and the end of the limb sharp-



FIG. 15.—HAY HOOK.

ened also, as shown in the cut. Plunge this into the stack as far as you can and pull out. It will be found very useful.

Fig. 16 shows another form of corn horse, called a crab. One of the legs is fastened firmly to the block; the others are fitted in loosely, so that they can be easily removed. In shocking corn with a horse of any kind, the center of the shock should be set quite straight, and when twenty or thirty hills are set up, tie firmly, and when the shock is finished tie it tightly again.

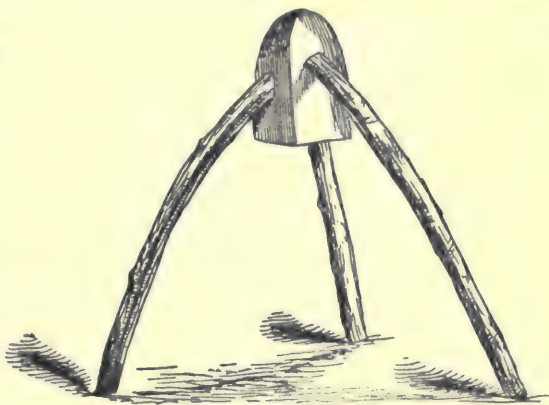


FIG. 16.—CRAB FOR SHOCKING CORN.

Fig. 17 shows a broom-corn scraper. It is a cheap way to get the year's stock of brooms to grow your own brush, and the above simple device, which can be made in a few minutes, will answer to scrape the seed from a few hundred pounds. It is made by sawing into the end of a tough half-inch board, so as to make a comb. The teeth should be tapered a little both ways, and pointed at the top. It should be a foot wide, and the cuts six inches

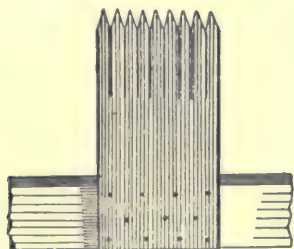


FIG. 17.—CHEAP BROOM-CORN SCRAPER.

deep. Nail firmly to a heavy piece of timber so that it will lean a little from the operator. To remove the seed, strike the brush onto the comb and pull towards you.

A cheap and convenient bag-holder will be found a great convenience, and this is shown in Fig. 18. The arm which holds the bag is hung on a bolt, which fits loosely, so as to raise or lower it to suit different lengths of bags. When not in use it can be let down, as it will

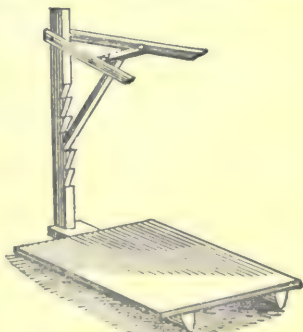


FIG. 18.—BAG-HOLDER.

be less in the way and not so likely to be broken. The addition of wheels to the platform would make it still more convenient.

As chickens furnish a large part of the meat used on the farm in the summer, and when killed in the ordinary way often bruise and dirty themselves, we give an illustration (Fig. 19) of an arrangement for holding them while cutting off their heads and afterwards while bleeding. The post should be set firmly in the ground and the top sawed off square. Saw a notch in a board to receive the fowl's neck, and nail to the back of the post. Make the hoppers eight inches square at the top and let them taper to two inches at the bottom.

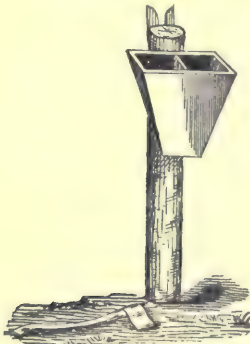


FIG. 19.—KILLING-POST FOR FOWLS.

As soon as the head is cut off, drop the fowl in the hopper, neck down. It can not bruise itself, and is in a position to drain all the blood out of its body. Any one will appreciate this who has had his clothes dabbled with blood, or who has been obliged to hunt ten minutes for a chicken that had flopped fifty feet into the high, wet weeds on a dewy morning, and find it dripping and dirty.



FIG. 20.—TO PREVENT SELF-SUCKING.

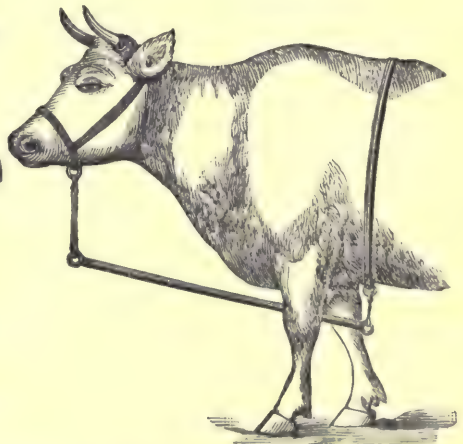


FIG. 21.—ANOTHER METHOD TO PREVENT SELF-SUCKING.

Figs. 20 and 21 show a cheap and convenient device to prevent a cow from sucking herself. Either style may be used and will be found effectual.

Fig. 22 shows another device for the prevention of self-sucking, which is easily made and applied. The spikes shown in the cut should not be used unless it is found absolutely necessary, as they will prevent the cow from using her head to fight flies in warm weather. The frames are fastened together at the top with leather or strong cloth, and by straps and buckles below.



FIG. 22.—FRAME FOR NECK TO PREVENT SELF-SUCKING.

The nose jewel illustrated in Fig. 23 may be used on a cow to prevent self-sucking, or on a calf which you wish to wean. In order that they may fit so as to not be easily



FIG. 23.—NOSE JEWEL.

removed by the animal, it is best to have one side movable and put on with screws, as shown in the cut. It should be made of hard wood, half or three-fourths inch thick, and well polished.

A snow-plow will save a good deal of labor in shoveling out paths in winter, in localities where deep snows fall, and the one shown in Fig. 24 is cheap and effective. With such a snow-plow it will be quick work to make all the paths needed on the farm, to the nearest neighbors, or to the school.

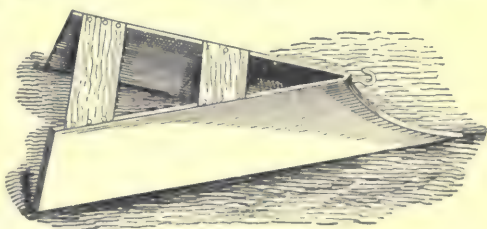


FIG. 24.—SNOW-PLOW.

Fig. 25 shows a form of flood-gate which will be found cheap and durable in many localities. It could be used in connection with the hogshhead abutments illustrated in our fence chapter, in which case staples should be driven through the staves of the hogshheads and clinched before they are filled with stone. A stream twenty feet wide or more can be fenced in

this way. If not more than twelve or fifteen feet wide, but one set of rails would be needed, which could be hinged at one

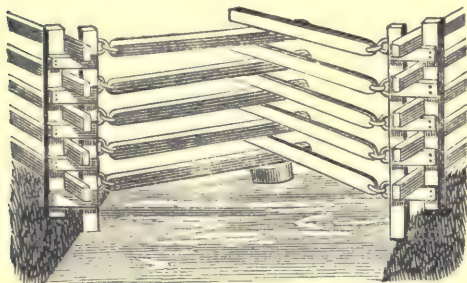


FIG. 25.—WATER-GAP.

end and rest on pins driven into the post at the other. The pins should be on the lower side and should slant upward, so that the rails would not be easily blown or crowded off from them, but as the water rises they will be lifted and float around.

Fig. 26 illustrates a cheap and effective stump-puller which can be made by many farmers themselves or by any blacksmith, and by means of which two horses can twist quite a large stump out of the ground.

It should be made as strong as possible, as there will be such a leverage in using it, that two horses can exert great power. The point *p* is driven into the stump, the chain passed half-way round, and the lever put through a link, and the horses attached to the hook.

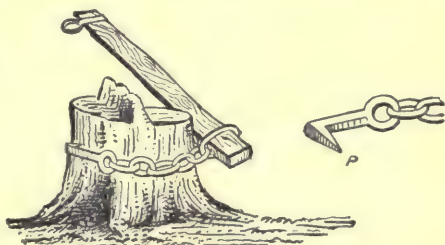


FIG. 26.—STUMP-PULLER.

Fig. 27 shows an attachment to a wagon-bed, to be used when corn, potatoes, sawdust, etc., is to be shoveled out. When attached to the wagon, the tail-board can be at once removed

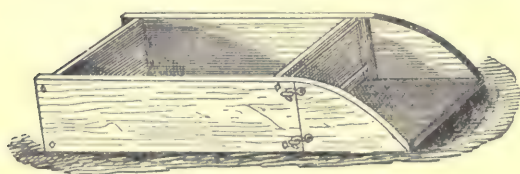


FIG. 27.—WAGON-BED ATTACHMENT.

without spilling any of the load on the ground. When not wanted, it can be taken off and put away. This is a great improvement on the plan

of placing a board inside the bed with one end on the top of the tail-board and the other on the bottom of the bed of the wagon.

Figs. 28 and 29 illustrate a dumping-sled for drawing manure, stone, or earth. The sled may be used either side up,

and drawn either backward or forward. The runners are made of strong plank, and serve for side-boards as well as runners. The manner of dumping is shown in Fig. 29. The short chain is unfastened, and the team is allowed to draw by the long chain, which dumps the sled.



FIG. 28.—SELF-DUMPING SLED EMPTY.

Fig. 30 illustrates a cheap and convenient potato screen, by means of which not only the loose earth among the potatoes, but the small potatoes also can be taken out. The slats should

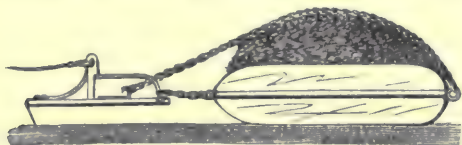


FIG. 29.—SELF-DUMPING SLED LOADED.

be rounded on the upper side and planed smooth, so as to reduce friction as much as possible, and should be a little wider apart at the bottom than the top of the screen. A good width for it is twenty inches, and the lower end should be high enough to receive a basket. Often it can be so arranged that the potatoes can be run directly into a bin in the cellar through a window. An old cloth spread under the screen will facilitate gathering up what passes through, and also prevent dirt and litter near the house.

Fig. 31 shows a cover for a roller. It is well known that exposure to the weather damages farm machinery more than its use, and as the roller is large and awkward to put in the shed and occupies a good deal of space, it is more likely to be left out than most implements. If raised a few inches from the ground and covered with a box like that shown in our engraving, it will be as



FIG. 30.—POTATO SCREEN.

secure as if in the barn. The sides of this cover should be of light lumber and lapped like weather-boarding to keep out the rain. The top should be of matched lumber and well painted.

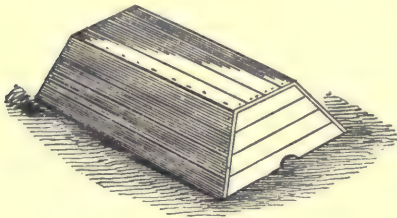


FIG. 31.—ROLLER COVER.

water can be boiled in it in much less time than in an iron kettle. The box should be of two-inch plank, and sixteen inches wider than the fire chamber. The sheet iron can be put on with common shingle nails. The furnace can be built of stone laid up with clay, which will endure the heat much better than lime mortar. Care must be taken to protect the wood at the ends from the fire. The sides will be well protected by extending out on to the wall. The furnace should be made high, so as to give room for the wood, and a piece of sheet iron will answer for a door. Any laborer can build such a furnace, for the wall being covered with earth can be built rough. The entire expense for a pan that will cook two barrels should not exceed five dollars. An old stove-pipe can be used for a chimney. When the pan

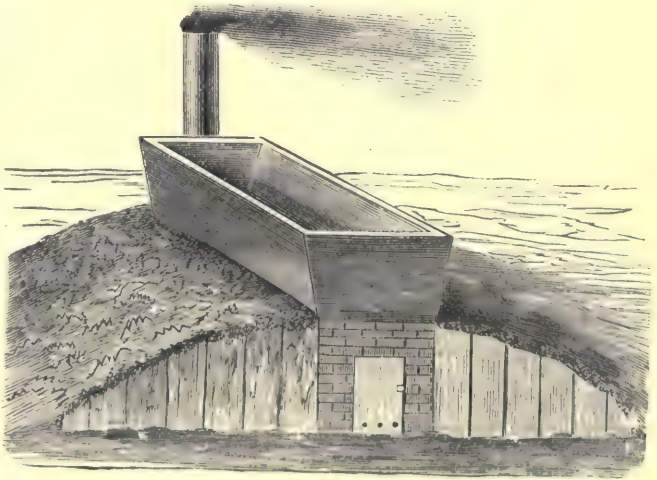


FIG. 32.—FEED COOKER.

is emptied, care must be taken to see that the fire is all out, or a little cold water put in the pan, as the bottom is so thin it will be easily burned out. If the door is left open, the draft will

soon cool the furnace. I prefer this to any of the high-priced steamers or cookers I have ever seen.

Fig. 33 shows a simple three-horse evener, which can be made by any blacksmith. While ordinarily the single horse hitched to the upper part will want twice the length of shank that the two hitched below will, it would be well to have several holes, so as to vary it to suit a light or heavy horse.

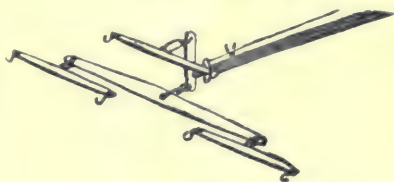


FIG. 33.—EVENER.

Fig. 34 shows a simple device for measuring land. It is a wheel sixteen and one-half feet in circumference, so that each revolution will make a rod. The rim can be spaced off into feet, so as to measure fractions of a rod. One spoke should be painted a different color from the rest, or can have a white or red strip of cloth tied around it, so as to make no mistakes in counting the revolutions. Mine was made from an old spinning wheel; but an old buggy hub can easily be provided with long spokes and a light rim, and will answer for the purpose. By holding the handle, it can be trundled in front of the operator and the revolutions counted, and a field measured almost as accurately as by two men carrying a chain.

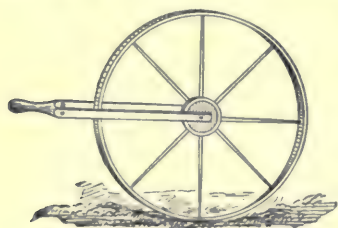


FIG. 34.—LAND MEASURER.

It is often desirable to tether a horse or cow in order to save grass that is not protected by a fence, so that the animal can be turned on it, and to do this safely requires a good tether-pin with swivel, as shown in Fig. 35. By the use of such a pin and a chain instead of a rope, the animal may be tethered with perfect safety, as it is impossible to wind up the chain on the pin.



Fig. 36 on page 416, shows a rack for hanging a beef. The cross-piece should be square at the ends and fitted to the front uprights so that they can not

FIG. 35.—TETHER PIN.

turn, while the single upright at the rear should have a round hole, so as turn on the cross-piece. The hooks should be movable, so as to be adjusted to a large or small beef.

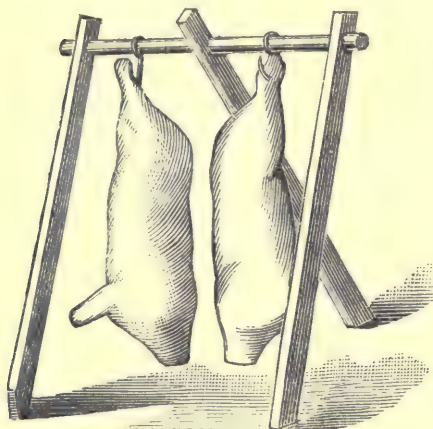


FIG. 36.—BEEF RACK.

may be two inches wide and from two to three inches apart, according to the size of fowls to be shipped. Cheap handles can be made by boring half-inch holes and passing a small rope through, tying a knot on the inside to prevent it from slipping through. The bottom should be closed tight for six

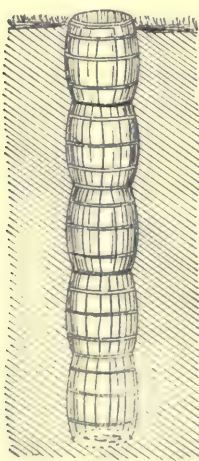


FIG. 38.—BARREL WELL-CURB.

inches to prevent the fowls from getting their legs through.

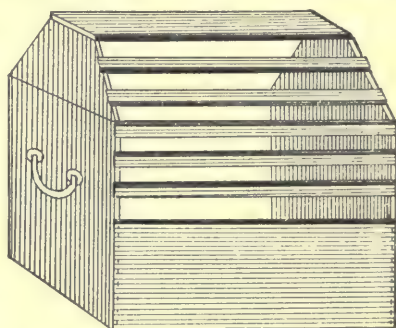


FIG. 37.—SHIPPING-BOX FOR FOWLS.

Fig. 38 shows what is called “a make-shift well curbing.” In a new prairie country, where stone can not be had, the new settler often needs a well at once before he is able to pay for brick to wall it. Good oak hogsheads can often be bought cheaply, and will last in the ground for many years, or if these can not be had, even cement barrels will answer the purpose.

It is often necessary to stack hay or corn fodder when a

little damp, so that there is more or less danger of molding, and if the stack can be arranged so as to give ventilation

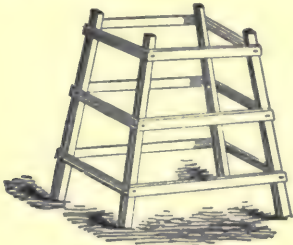


FIG. 39.—SECTION OF VENTILATOR.

through the center, this danger will be greatly reduced. Fig. 39 shows how a cheap frame can be made to be used for this purpose, and Fig. 40 shows how they can be placed one above another and carried up to any desired height. The corner pieces should be two inches square, and three-inch strips of board will be sufficient to hold them together. When once made with care they will last for years.

Fig. 41 shows another cheap way of ventilating a hay or fodder stack, while Fig. 42 shows how two boards nailed together may keep open a passage for the air and insure perfect ventilation.

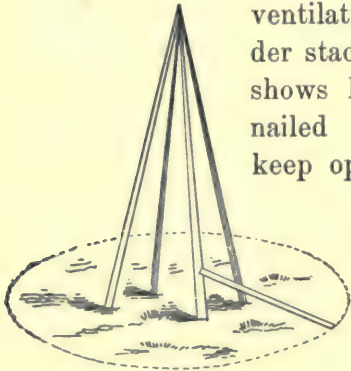


FIG. 41.—VENTILATOR FOR STACK.

Fig. 43 on page 418 illustrates a bushel box. These are not only much cheaper than baskets, but more convenient, especially for the market gardener, as they pack into a wagon better. They are also better than barrels for storing winter apples in the cellar, as they are light to handle and can be placed one above another to the ceiling and afford good ventilation. To hold a bushel and not be so full but that they can be set on top of each other, they should be made one foot wide, one foot deep, and eighteen and a half inches

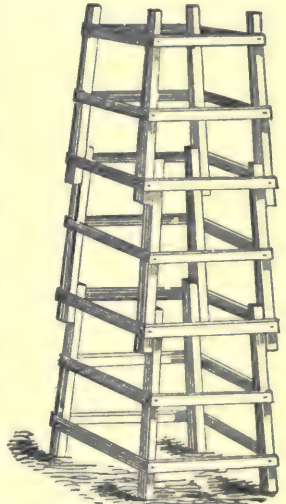


FIG. 40.—VENTILATOR.



FIG. 42.—BOTTOM VENTILATION.

long. Make the ends of inch pine with holes cut for handles, and the bottom and sides of lath or narrow strips.

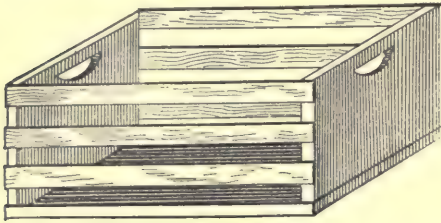


FIG. 43.—A BUSHEL-BOX.

with the other end flattened and two or three holes punched in it so it can be nailed to the post.

Figures 45 and 46 illustrate a form of gate which will be found very convenient in localities where deep snows make it difficult to keep the passageway clear so that a gate will swing readily. The gate is cheap and easily made. It should be put together with bolts and the post to which the

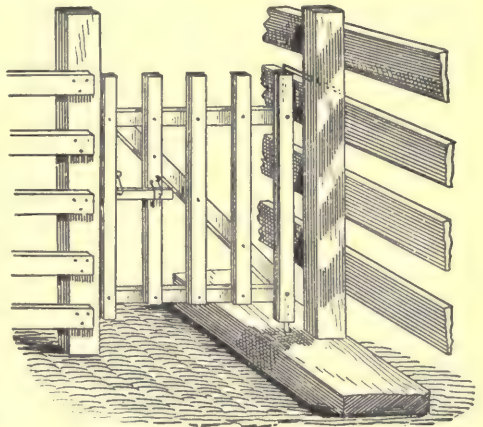


FIG. 44.—PIVOT-HINGED GATE.

gate is hung must be set leaning. A gallon paint pail, filled with small stone can be used for a weight.

Fig. 47 illustrates a double pivot gate which is very cheap and convenient, particularly for pas-

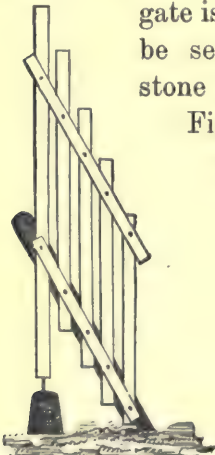


FIG. 45.—GATE HUNG WITH WEIGHT, OPEN.

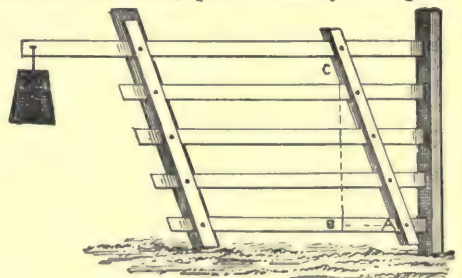


FIG. 46.—GATE HUNG WITH WEIGHT, CLOSED.

tures where large herds of cattle are to be driven through. No hinges will be needed, as the upright in the center will

be rounded to two inches and fitted into a hole in the top cross-piece, and the bottom to a hole in a post or piece of timber at the bottom. The long braces will keep the gate from sagging. The latch and catch can be made so that the gate can be swung either way.

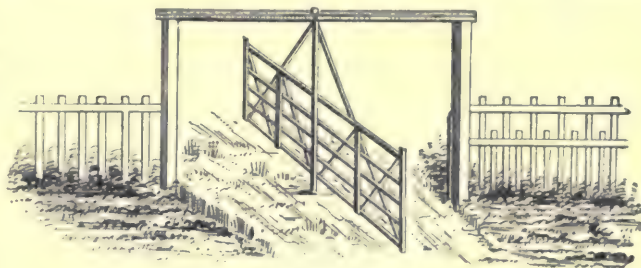


FIG. 47.—DOUBLE PIVOT GATE.

Fig. 48 illustrates a very convenient form of ladder for the orchard. Old wheels can be found on many farms or can be bought very cheap at the repair shops, and the cost of fitting up such a ladder would be trifling compared with the benefit derived from it in the orchard. Care must be exercised in making it that it does not extend so high as to overbalance with the weight of a basket of fruit.

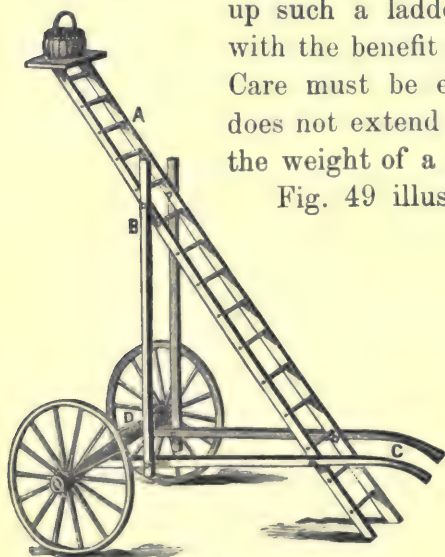


FIG. 48.—BARROW LADDER.

found very useful in the orchard. The finer fruit grows at the extremities of the branches, and usually can not be reached by a ladder which must be supported by leaning against the tree, as the branches are not strong enough to support the ladder with the added weight of a man.

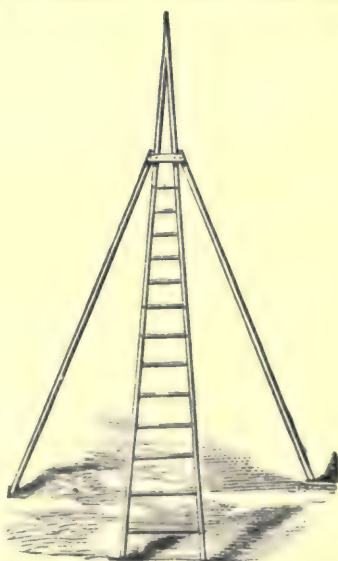


FIG. 49.—SELF-SUPPORTING LADDER.

With such a ladder as the above the fruit at the ends of the branches can be easily reached. The braces which support this ladder are secured by a single bolt to a piece of board firmly bolted to the top of the ladder.

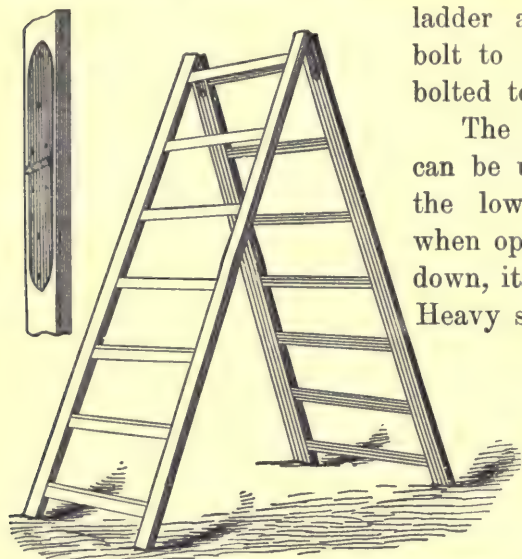


FIG. 50.—COMBINED STRAIGHT AND STEP-LADDER.

made to stand firmly by placing it in a small fork, where a common two-sided ladder would not go. If made of free-splitting timber, a bolt with washers should be used at the upper part of the split.

It is often necessary to put up a scarecrow of some kind to protect the corn-fields or poultry-yard, and we here illustrate two. Fig. 52 is an imitation crow made by sticking feathers into a cork or block of wood. The piece of bright tin above serves to help keep it in motion, and by its reflection makes it more effective. In Fig. 53 the tin is hung below and a pair of nails

The ladder shown in Fig. 50 can be used as a step-ladder for the low trees or branches, or when open and turned hinge side down, its length will be doubled. Heavy strap hinges, such as are used on gates will answer the purpose.

Fig. 51 shows a cheap ladder which possesses some advantages. If made of light wood it is easily raised, and can be



FIG. 51.—POLE LADDER.

so arranged as to strike the sides of a bottle from which the bottom has been removed, or an old tin can may be substituted for the bottle. The noise added to the motion makes this more terrifying to the birds.

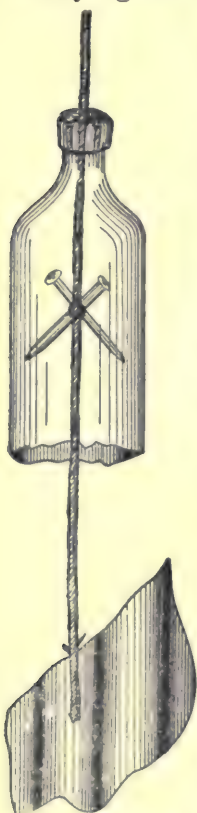


FIG. 53.—BOTTLE SCARE-CROW.

such a "rack" as this the sheep do not waste the hay or interfere with each other. It will be best to have the hogsheads hooped with old buggy tires, as the cost will be small and it will make them more durable.

It is often advisable to

It is often desirable to protect valuable plants, either from the sun or frost, and Fig. 54 shows a convenient and simple plan. The left hand figure shows twigs bent and stuck in the ground to form an arch, while at the right hand these twigs are covered with a newspaper, which is kept in place by clods or small stones laid on the edges.

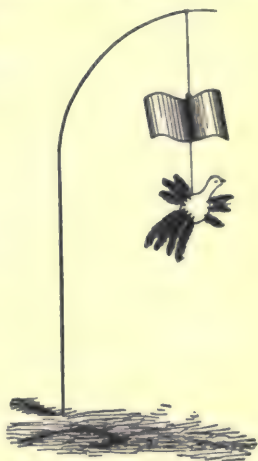


FIG. 52.—A SCARE-CROW.

Fig. 55 shows a hogshead sheep rack. Mr. J. M. Jameson writes me that he has used this for some years and is much pleased with it.

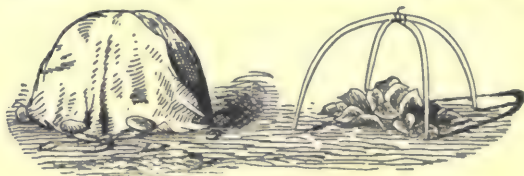


FIG. 54.—PLANT PROTECTOR.

He cuts nine holes in a hogshead three feet in diameter. The holes should be ten inches in diameter in the widest part. When fed from



FIG. 55.—HOGSHEAD SHEEP RACK.

keep some of the cattle in the barn-yard when there is good shelter at the stack, and they will need a little meal or grain.

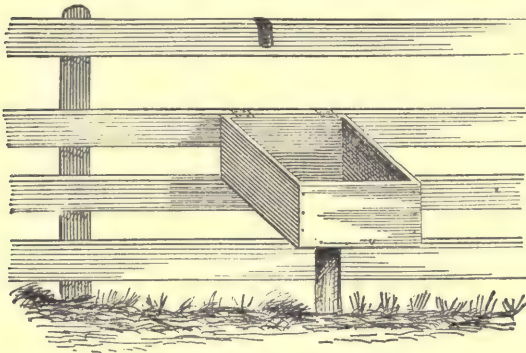


FIG. 56.—HINGED FEED-BOX.

place by an iron hasp or wooden catch.

Fig. 57 shows a box to be set on the ground, with an upright, which can be used for a handle to move it, or which will keep the edges out of the mud if it is turned over.

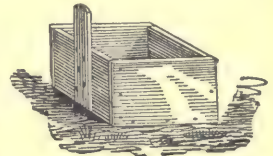


FIG. 57.—FEED-BOX WITH HANDLE.

Fig. 58 shows a box with a hinged lid, which can be closed when desired.

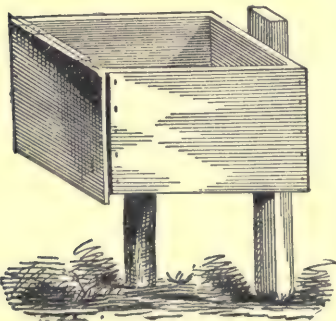


FIG. 58.—FEED-BOX WITH COVER.

found a great convenience and saving of time where large flocks are to be handled.

Fig. 60 illustrates a method of prevention and cure for a butting ram. Valuable rams are often so confirmed in the habit of butting as to render it necessary to kill

Fig. 59 illustrates a trough or table for tagging sheep. A sheep placed on its back in this can not turn over, and, without being tied, can be readily managed by one man. It will be

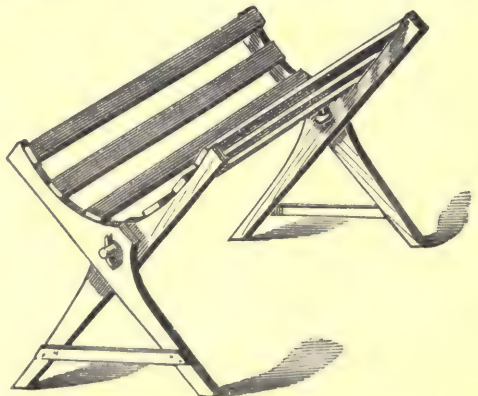


FIG. 59.—TAGGING-TABLE FOR SHEEP.

or cure them, as they become dangerous. As a ram always backs a few steps to prepare for a lunge, if a pair of light poles are fastened to his horns so as to prevent his backing, his butting intentions will be diverted. After wearing them for a short time, one can be removed, and when the habit is cured the other taken off.



FIG. 60.—BUTTING PREVENTOR.

Fig. 61 illustrates a sheep shearing table.

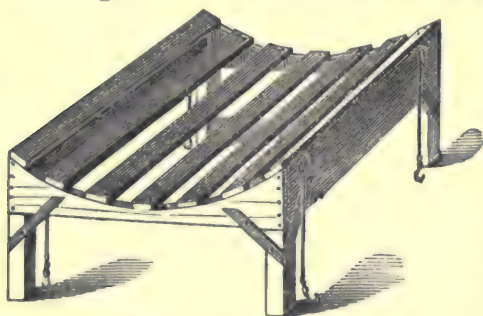


FIG. 61.—SHEARING TABLE.

The cords shown at the sides can be used for fastening its legs if necessary. The table can be made of a height to suit the shearer.

In these days of fine-bred hogs it is often quicker and safer to take them to market in a wagon than to drive them, and such a rack as is illustrated by Fig. 62 will be found very convenient in loading and unloading them. It can be made so as to be taken apart when not in use, as it will be lighter to handle and easier to store. There should be cleats nailed on the floor to prevent the hogs from slipping. The rack for the bed will often be found of advantage in hauling stove wood, pumpkins, or any light material of which the horses can draw more than a wagon bed full.

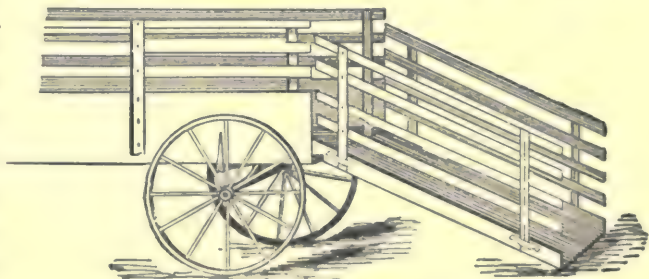


FIG. 62.—HOG LOADER.

Fig. 63 shows a home-made root-cutter. The farmer who

grows a large quantity of beets or other roots to feed will want

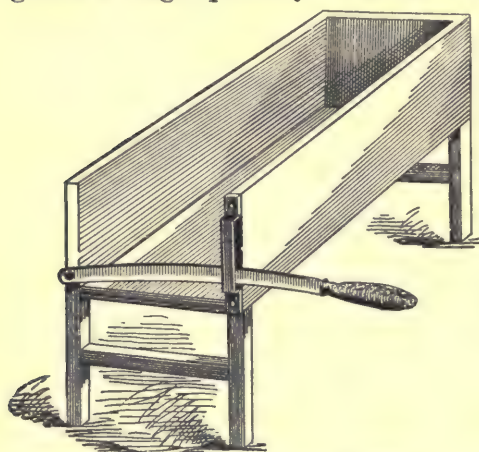


FIG. 63.—HOME-MADE ROOT CUTTER.

a better and more expensive machine, but one such as shown in the cut will answer the purpose where but one or two cows are to be fed. The box should be large enough to hold a bushel or more of roots without their being in the way of the operator.

Some very valuable horses acquire a nervous habit of kicking in the stable, and although they are not vicious and only kick in play, the habit is very annoying. One of the best horses I ever owned would kick the harness down when it was hung six feet from the floor, or if put in a stable where he could reach the weatherboarding, he would batter it off before morning. The simple device shown in Fig. 64 is said to be an effective cure. When the horse kicks the log it swings back and strikes him and he soon learns to be quiet. The stick should be smooth, not too heavy, and hung near enough to the horse so that he can not kick it with full force. A hook or rack should be arranged to receive it when it is not needed.

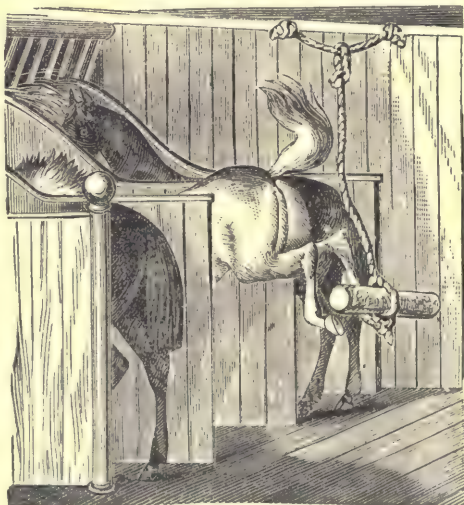


FIG. 64.—TO CURE THE KICKING HABIT.

Fig. 65 shows a hanging milk and fruit shelf which is not only inaccessible to rats and mice, but affords a good circulation of air. It can be made of any size desired. The floor may be

supported by nailing inch boards to the hanging supports, or the latter may be mortised. If long shelves are wanted, a middle support will be necessary.

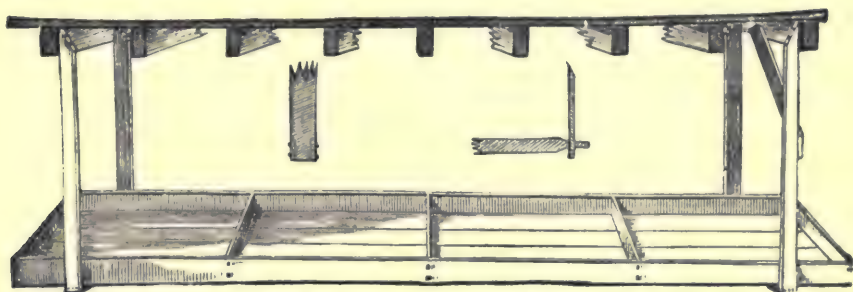


FIG. 65.—HANGING RAT-PROOF SHELF.

The sun and wind are the great purifiers, and the housewife understanding this, puts out her milk pans, pails, dish-cloths, etc., where they can receive their full benefit. Fig. 66 shows a convenient rack for the purpose, and one that will save steps, as it can be revolved so as to bring any article to the side nearest the kitchen door. An old buggy wheel that has served its time for purposes of locomotion, may have years of usefulness added to its existence, and also save the farmer's wife many steps, by doing duty in this way.

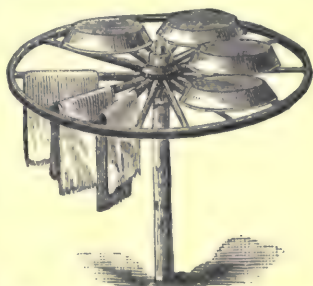


FIG. 66.—WHEEL DRYING RACK.

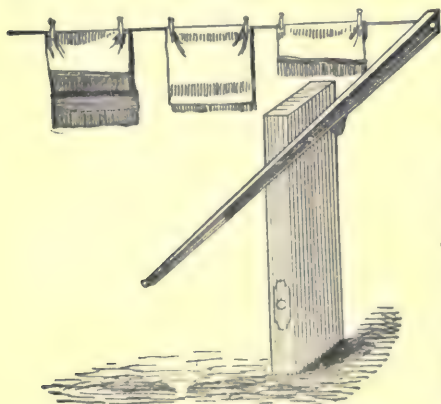


FIG. 67.—CLOTHES LINE LIFTER.

Fig. 67 shows a simple device for elevating the clothes line. It is inconvenient for a woman to reach to hang sheets, table-cloths, etc., as high as they ought to be while drying, and by this arrangement the clothes can be hung with the line low and then raised. The post should be broad, and the lever bolted to it so as to turn on the bolt, and pins can be arranged

so as to keep the line at any desired height.

Fig. 68 shows a good foot-scraper, such as should be found at every door. If the boys—and men—are taught to use the

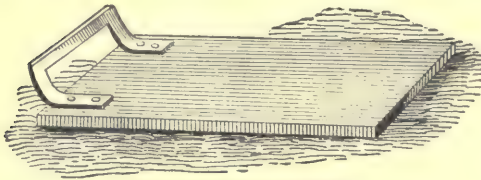


FIG. 68.—FOOT-SCRAPER.

scraper in muddy weather whenever they come into the house, and an old broom is kept hanging by it to sweep the feet, much labor in sweeping and dust

and dirt on the carpets will be avoided, and in many cases cross words and hard thoughts prevented.

Fig. 69 shows how an old spade can be utilized for a scraper, and a little ingenuity will enable one to arrange an old broom on either side to clean the sides of the boots.

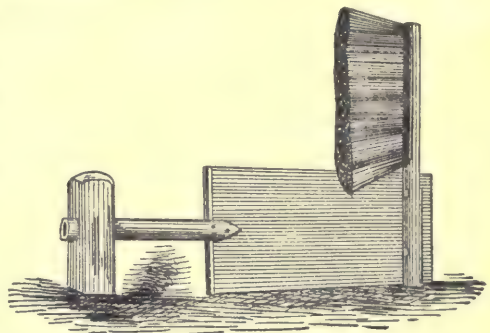


FIG. 69.—FOOT-SCRAPER AND BRUSH.

Home-made articles of furniture are often more appreciated than those bought from the shop. Our cut shows how an easy-chair can be made from a barrel. Fig. 70 shows how it should be cut



FIG. 70.—BARREL CHAIR.



FIG. 71.—BARREL CHAIR UPHOLSTERED.

and how the castors are attached, while Fig. 71 shows how the chair will look after it is finished.

While visiting Professor Townshend at Columbus, he had occasion to refer to a book on a high shelf in his library, and

getting up he took hold of the back of his chair and in a twinkling it was converted into a step-ladder. Such a chair would be a convenience in every house, as the housekeeper almost

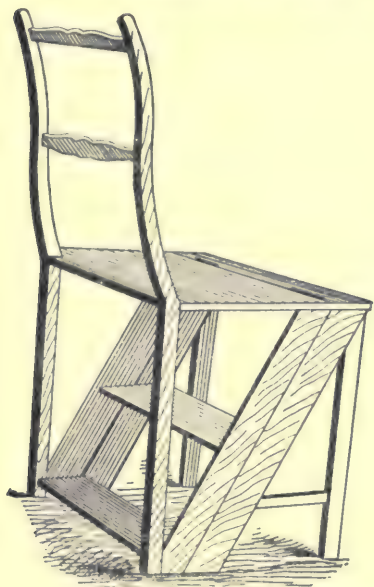


FIG. 72.—CHAIR AND STEP-LADDER.



FIG. 73.—AS A STEP-LADDER.

daily needs to hang a picture, arrange a curtain, wash a window, or reach a high shelf. The chair (Figs. 72, 73) can be neatly finished, so as to be ornamental, and when not wanted as a step-ladder can be used as a chair.

Figs. 74 and 75 illustrate another simple convenience, and



FIG. 74.—TOOL-BOX CHAIR CLOSED.



FIG. 75.—TOOL-BOX CHAIR OPEN.

may be used for a variety of purposes. If the farmer has some mechanical skill and wishes to work evenings, he can use this

to keep his tools, awls, gimlet, hammer, etc. It would, if not wanted for this purpose, make an excellent place to keep the blacking brush and blacking, or the shoes for a small family could be kept in it. One could be used by the mother for stockings and darning material. If neatly made and cushioned, it would look well and make a comfortable chair, and if on castors, could be easily moved. It should be made just the height of an ordinary chair.

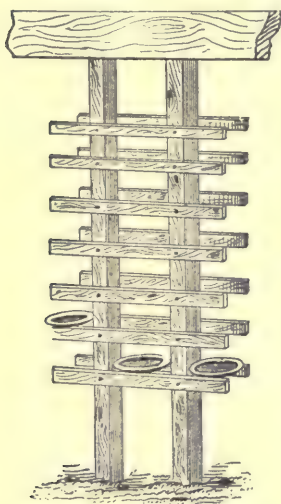


FIG. 76.—SLAT SHELVES.

Fig. 76 shows a set of stationary slat shelves. They have many advantages over boards. They are much cheaper and more easily kept clean, and when used for milk, the bottom of the pan being exposed to the air, the milk cools sooner than when on a board shelf. These shelves can easily be made inaccessible to rats, as suggested for the revolving shelves.

There is no simpler device to prevent a cow from sucking herself than that shown in Fig. 77. The stick should be of hard wood, and the ends sharpened and firmly bound to the horns. It can be removed when the cow loses the inclination to suck, which will usually be in a short time.



FIG. 77.—TO PREVENT SELF-SUCKING.

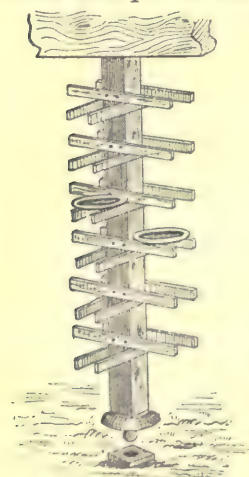


FIG. 78.—REVOLVING SHELVES.

We have for many years used in the cellar a set of shelves made to revolve, as shown in Fig. 78. It is very easily and quickly made. The upright should be four inches square, and the strips half inch thick and two inches wide. They should project far enough to receive a milk pan or plate.

The post or upright should have a strong pin of hard wood in

each end. The upper one will pass through a hole in a board nailed to the joists above, and the lower pin in a block on the cellar floor. Even if this is made stationary, it will be found very convenient, as it occupies but little room, and can be put up in a short time and at a very small expense. It can easily be made inaccessible to rats by putting the first slats two and half feet from the floor and covering the post with tin. The shelves may be any distance apart desired.

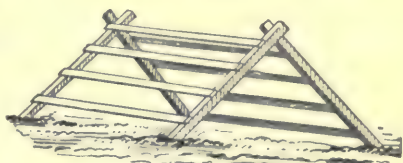


FIG. 79.—RACK FOR TOMATOES.

In growing early tomatoes for the family, it will pay to furnish some kind of support, as the fruit will be nicer, earlier, and more abundant than if the vines are allowed to trail on the ground. Fig. 79 shows a cheap rack, which can be made of refuse lumber, which will give good satisfaction for the purpose. A similar rack made of lath might be used for the tall varieties of peas.

Fig. 80 illustrates a cheap, portable shelter, which may be used for a sow and her litter when turned to pasture in spring, or it can be made high enough for calves, or one of them placed on a dry spot in the poultry yard and supplied with ashes would make a good wallowing place for the chickens and turkeys in bad weather.

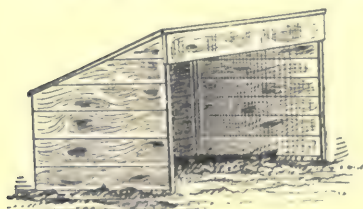


FIG. 80 —PORTABLE SHELTER.

Fig. 81 shows a cheap and convenient garden reel. The side pieces A A are slightly curved to the center. The cross pieces B B are two inches wide and three-quarters of an inch thick. The center stake C should be two and a half feet long and with a shoulder below the lower cross-piece. A pin through it above the upper cross-piece holds it in place. The cord is wound up by the handle D, and the other end is fastened to the stake E. All parts

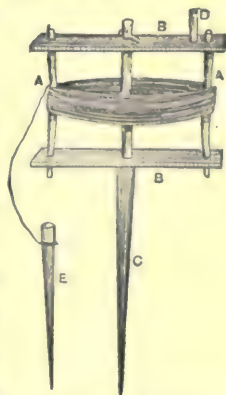


FIG. 81.—A GARDEN REEL.

of the reel should be made of hard wood, and for the stakes there is none that I am familiar with so good as the osage orange.

In many localities a water gap may be made as shown in Fig. 82. All the timbers used should be strong and of durable

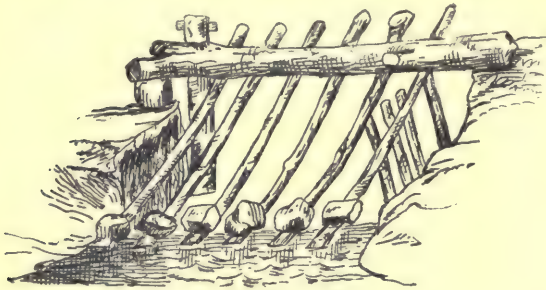


FIG. 82.—ANOTHER WATER-GAP.

timber. The end of the poles resting in the bed of the stream must be weighted down with stone. If it is desirable to fill up the bed of the creek, brush and straw placed on the

poles will stop the sediment and soon make a dam that will stop the wash. In suitable locations there is no better way of fencing across a stream.

Some of our flowering plants are weak in the stem and require support, or they are easily beaten down by the rain. A cheap and tasty support for such plants may be made of heavy wire, as shown in Fig. 83. A similar one, made strong enough to support a coffee boiler, would be very convenient for picnic parties when getting up a dinner in the woods.

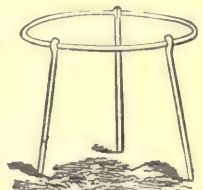


FIG. 83.—A WIRE STAND OR SUPPORT.

In topping out a stack, the distance is often too great for one to pitch from a wagon the last material needed, and one can not well stand on a common ladder and take hay or sheaves on a fork and pass them up to the one finishing the stack. Fig. 84 shows how a platform may be arranged on which the middle man can stand and work with ease and safety.

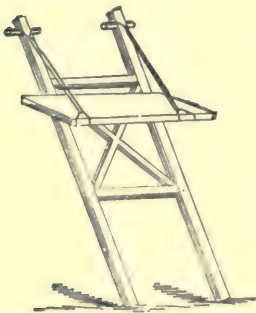


FIG. 84.—STACKING STAGE.

There are many horses who have the bad habit of throwing the hay or fodder out of the manger, either under their feet or else over the front of the manger. Fig. 85 shows a simple de-

vice to prevent this. The rack, which is shown turned up, is made of iron—old, worn tires are suitable and cheap—and hinged so that it can be turned up at the front of the manger or turned down so as to rest on the hay. The bars of the rack should be ten inches apart, so that the horse can easily get his nose through to eat. I would recommend a slatted floor to the manger, and that it be placed a foot or eighteen inches above the stable floor. The dirt and waste will then fall on the floor and go out with the soiled bedding.

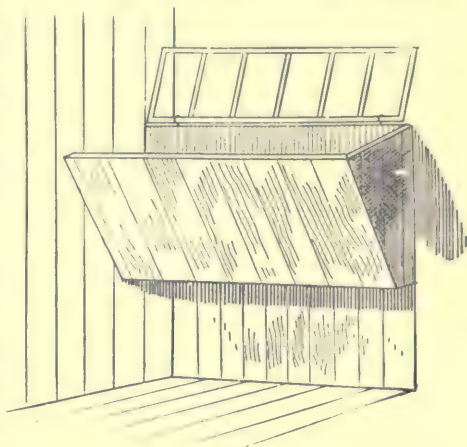


FIG. 85.—RACK AND MANGER.

Many of our readers, who keep a diary of the weather, would without doubt be glad also to keep a record of the rain-fall. Fig. 86 shows how a cheap rain gauge may be made, which for all practical purposes will be accurate enough. A scale of inches and fractions should be marked on a common two-quart glass fruit jar, a cork fitted into the neck, and a funnel with the top exactly the size of the inside diameter of the jar fitted through the cork. It will be best to keep it in a covered box with only the top of the funnel projecting above the cover. It should be placed where there will be no trees or buildings to interfere with the rain-fall. For winter use, when there is danger of freezing, the jar can be protected by dry saw-dust.

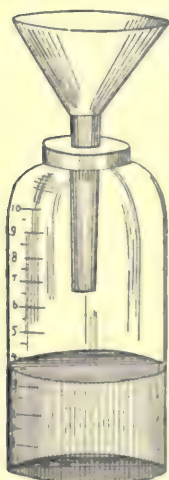


FIG. 86.—A HOME-MADE RAIN GAUGE.

Fig. 87 shows a cheap and convenient land measurer. It may be made of two sections of old wagon bows or of limbs having a natural curve. The legs A A should be mortised, and the cross piece B should pass through the mortises and be marked with feet and inches, and a thumb-screw inserted in one of the legs to hold it to its place. When you wish to

measure across a field, set it to four feet one and a half inches, and four measurements will be just one rod. It will be found very convenient to mark the spaces for plants in the garden, or the distance apart for rows where accuracy is desirable. It is used like a pair of compasses, by stepping or pivoting it along.

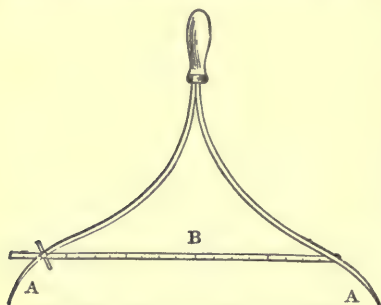


FIG. 78.—CHEAP LAND MEASURER.

Fig. 88 shows how an old barrel can be utilized for a chicken coop. If large barrels—sugar barrels, for example—are used, the coops will be of comfortable size. If more room is needed, two of them can be placed side by side, and two or more staves cut out of each to make an opening large enough for the hens to pass through, and these openings placed opposite each other. If there is danger from rats, one barrel should be set on a board floor, and should have but one opening, and this should be closed at night. Some auger holes should be bored in the staves for ventilation.

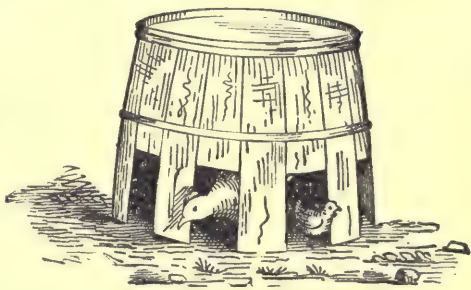


FIG. 88.—BARREL COOP.

The poultry raiser is often troubled by the depredations of minks or other small animals which prey upon his flocks, and

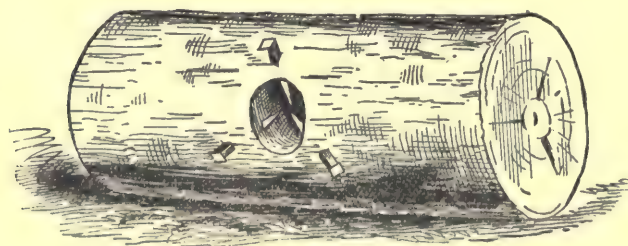


FIG. 89.—A MINK TRAP.

these animals are so cunning as to make it difficult to trap them. A hole can be cut in a log and sharp spikes driven in at such an angle that the head of the animal will readily slip past them when it attempts to reach the bait beyond them, but will hold it when it attempts to draw the head out. The hole

should be rubbed with earth so as to make it look dark like the outside of the log, as if it was left fresh and white it would be likely to excite suspicion.

Every farmer who has tried holding a hog to ring or snout knows how difficult it is to keep them still, so that the operation can be well performed. By using a noose, as shown in Fig. 90, the pig will hold himself. Often the noose can be worked into his mouth when he is eating without catching him at all; but when caught, he at once begins to squeal and opens his mouth, when the noose can be passed round his upper jaw, and he at once pulls back and tightens it.

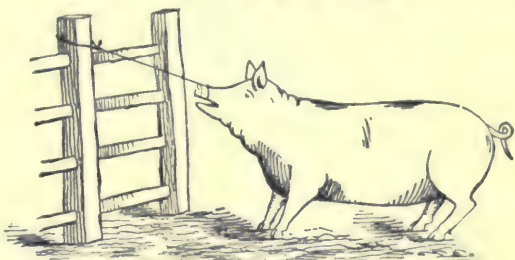


FIG. 90.—RINGING A HOG.



FIG. 91.—A RAT TRAP.

The losses to the farmer from the depredations of rats are enormous, and sometimes a single rat that develops a taste for young chickens may do several dollars worth of damage. A rat can usually be caught in a steel trap, by setting boards on edge so as to narrow to three inches, the point through which he must pass and covering the trap with bran or sawdust. Fig. 91 shows a trap by means of which a large number of rats may be caught. The top of the trap is hung with a pivot, the upper side being heavy enough so as to remain closed, but so nearly balanced that the weight of a rat on the other side will tip it. It will be best to fasten the drop and feed the rats for a few nights on top of the trap before setting it. Bait with toasted cheese. Put six inches of water in the bottom of the trap and place in it a piece of board three inches wide and six long. This will hold one rat, but if two or more get in they will fight for possession of the block and drown each other. This trap can be made of the half of a barrel, and the top can be laid over it with the trap-door or pit-fall in the center.

A device for holding bags is shown in Fig. 92. A strong table can be cheaply made, and your tinner will charge but little for a tin or sheet iron funnel. The funnel when pressed down closely will hold the bag in place. This could be used without the funnel by attaching the bag to small hooks on the table.

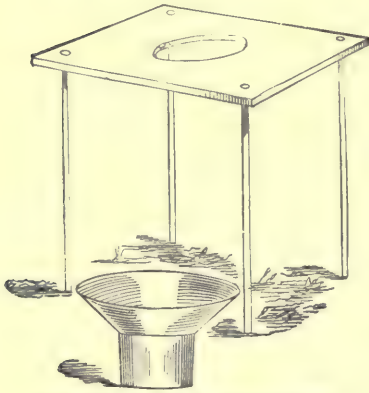


FIG. 92.—A CHEAP BAG-HOLDER.

from the fulcrum, and also by increasing the weight. In pressing cheese the pressure must be light at first or the cream will run off with the whey. The same press can be used for lard, jelly, etc.

There should be in every stable a closet where curry-combs, brushes, open links, rings, simple remedies, etc., can be kept free from dust and

Fig. 93 shows a good form of press for small cheeses. The amount of pressure can be regulated by moving the hoop near or farther

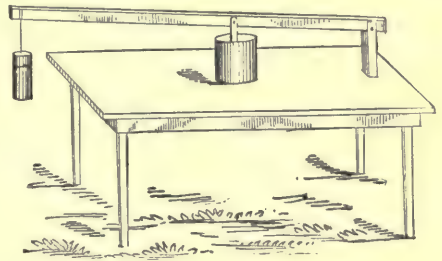


FIG. 93.—A HOME-MADE PRESS.

vermin. It can be made and attached to the wall as shown in Fig. 94. A similar closet with hooks, instead of shelves, can be arranged for the buggy harness, and the horse blankets can be either hung up or folded and laid on the bottom.

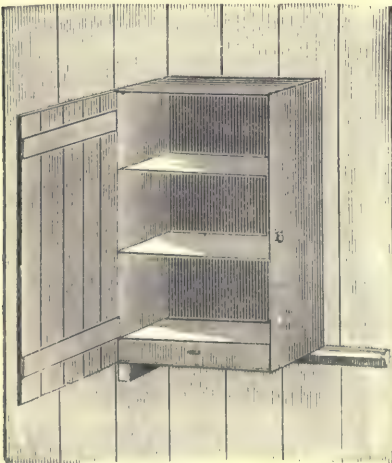


FIG. 94.—BARN-CLOSET.

The harness often needs the "stich in time" which will save the annoyance of a break in an emergency or a trip to town, and with some oak barrel staves a cheap and convenient clamp

(Fig. 95) can be easily made to hold it while mending. It is best to use screws to fasten the boards to the block, as there will be less danger of splitting. It will be easy to arrange this clamp so that the pressure will be sufficient to hold the leather.

Fig. 96 shows a cupboard or set of shelves, which will be found very convenient in the kitchen or summer kitchen. They can be made cheaply, and may be of any required

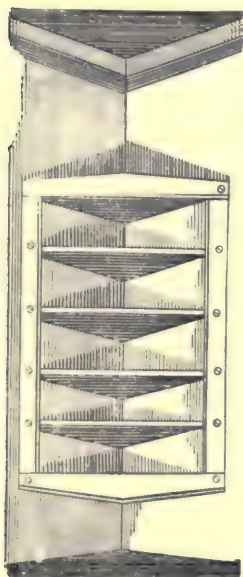


FIG. 96.—SET OF SHELVES.

A door can be fitted to the cupboard, or a curtain hung in front. If the latter, it should be made with rings to slide on a wire, so that it can be easily opened or closed.

In Fig. 97 we have a cheap and convenient saw-buck for sawing up long poles which can not be balanced on an ordinary saw-buck. Wood or old rails are often brought to the wood-yard in lengths varying from five to twelve feet, and such an arrangement as is shown in the engraving is both cheap and convenient in sawing these long pieces.

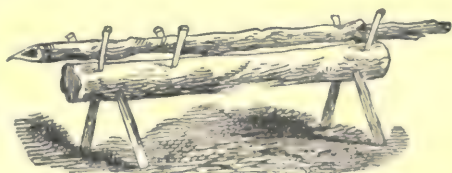


FIG. 97.—SAW-BUCK FOR LONG WOOD.



FIG. 95.—HARNESS CLAMP.

How a water-tight box or trough can be made is shown in Fig. 98. It will be found convenient for scalding hogs or to use as a trough to mix chop-feed for horses, as the sloping ends will be convenient when it is used for either purpose. It can also be used as a watering-trough. The sides should be of good, two-inch plank, and the ends fitted into galls,

and it should be put together with white lead. The rods should be of half-inch iron, and made with a tap at one end, so that it can be kept well drawn together.

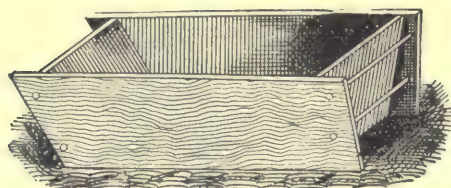


FIG. 98.—WATER-TIGHT BOX.

Fig. 99 shows a convenient hook for cleaning out the bottom of a horse's foot. It is often the case that ice or dung becomes compacted into the shoe, so that the horse can not stand to draw a load on an icy hill, and the teamster must clean out the hoof before starting up the hill. This hook is made with a hinge so that it can be folded and carried in the pocket, and thus always be on hand when needed.

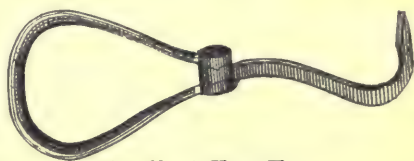


FIG. 99.—A HOOF HOOK.

It is often desirable to save as much as possible of the litter used for bedding the stock, and by the use of such a barrow as we show in the engraving the litter from several stalls can be wheeled out and left in the sun to dry, and brought back and used again at night. Such a barrow will also be found convenient for moving straw, corn-fodder, pea-brush, empty barrels, or any light bulky material.

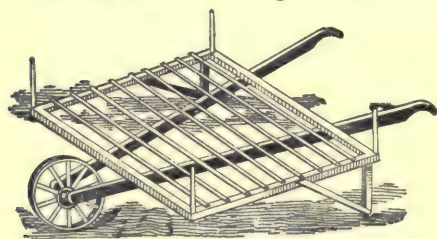


FIG. 100.—A STABLE BARROW.

It is often desirable to have a cheap, low sled, on which to move a barrel of vinegar or molasses or to draw in sugar-water. It will also be found convenient to move a harrow or plow from one field to another. Fig. 101 shows how such a sled can be made.

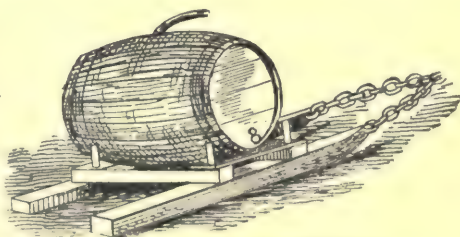


FIG. 101.—CHEAP BARREL-SLED.

THE PEOPLE'S FARM AND STOCK CYCLOPEDIA

EMBRACING

FARM STOCK IN ALL ITS DEPARTMENTS, INCLUDING THE BREEDING, CARE,
AND MANAGEMENT OF HORSES, CATTLE, HOGS, SHEEP, POULTRY,
BEES, ETC. ; FOODS FOR ANIMALS; BARNS AND BARN-YARDS;
THE DISEASES OF HORSES AND LIVE STOCK,

WITH NUMEROUS APPENDIXES

INVALUABLE FOR

REFERENCE IN ALL DEPARTMENTS OF AGRICULTURAL LIFE.

VOLUME II.



INTRODUCTION.

SUCCESSFUL farming means more than the growing of heavy crops. The farmer may begin on a fertile farm, and at first get heavy yields of grain, but if he follows this for a series of years, selling the grain and restoring nothing to the soil, his crops must decrease in yield until his lands cease to pay for cultivation. Again, the farmer may be situated at such a distance from market that the expense of delivering his grain will largely reduce the profits. In most localities the farmer will lighten his labor and increase his profits by making prominent the rearing and feeding of stock. In addition to this, and what is of greater importance, he will, by this means, be enabled to keep his land at a maximum degree of fertility.

No branch of farming requires greater intelligence or more careful study than the breeding and handling of stock. The fact that the farmer keeps on his farm stock enough to consume its products, does not, of itself, prove that he is making it profitable. Many questions are involved in the business of stock growing, with which we must be familiar before we can tell whether the farmer is making or losing money by it. The intelligent farmer should understand the various purposes for which he keeps stock, and should see that that which he keeps is adapted to the purpose intended. For example: The horse and mule are kept to furnish power, while the other domestic animals furnish food and clothing, and all furnish valuable fertilizers.

To make the greatest profit from stock requires attention to several points: 1st. The stock must be suited to the farm. 2d. The amount kept must correspond to the size of the farm. 3d. The stock of all kinds must be good, and there must be a

constant effort to improve it. 4th. Its food and care must be such as to give the best development for the purpose for which it is kept. 5th. It should always be managed so as to increase the fertility of the farm, both by the system of rotation which it renders practicable, and by the saving and intelligent application of the manure produced.

Although these points will be fully discussed in the various chapters of the book, I wish briefly to notice them here.

1st. The farmer who attempts to make pork a leading product must have a farm well adapted to corn. If his lands are broken and unfit for the plow, sheep will probably give the best profit, or if he keeps cattle he will need some of the smaller and more active breeds.

2d. On many farms too much stock is kept. Four old, run-down horses are kept to do the work that two good ones would easily perform. The farmer attempts to winter more stock than he has food for, and the consequent scrimping brings them to the spring in such poor condition that the best season of growth is required to get them back to the weight and condition of the previous autumn.

3d. The poorer quality of stock—which, unfortunately, is still too common—never does and never will give any profit. Scrub colts—that are never worth seventy-five dollars each—scrub cattle, which must be kept to three or four years old to attain a weight of one thousand pounds; leggy sheep, with light carcasses, which shear but three or four pounds of wool each, and “Elm Peeler” hogs, that like “Pharaoh’s lean kine,” are still thin and poor when they have devoured the products of the years of plenty—such stock the farmer should not keep. It should be remembered that stock never improves without care and watchfulness, and that as the neglected field will inevitably grow up to weeds and briers, so certainly will the stock on the farm deteriorate unless careful attention is given to breeding and feeding. The farmer who never consulted the market reports, and who sold his grain at a price far below what they were offering at his nearest station, would be thought a fit candidate for a lunatic asylum, but how much wiser is he

who feeds the products of his farm to stock so poorly bred that there is no possibility of profit from it.

4th. In feeding farm stock there should be an intelligent idea of the purpose for which the food is given, and some knowledge of the properties of the different foods and the purposes they subserve in the animal economy. These will be discussed fully in the chapter on Feeding Animals. I wish, however, briefly to state a few points :

(1.) Breeding stock should never be pampered and made over fat, as it often impairs their fertility, and injures their offspring. It is, therefore, often unwise to buy show stock at fairs for breeding purposes.

(2.) Working stock should be fed with those foods which produce muscle rather than fat, and the practice of heavy corn feeding for horses is both unscientific and injurious.

(3.) Growing stock must be fed liberally so as to maintain a constant development, for it takes less food and gives better results to keep an animal growing and thrifty, than to make it so after it has been checked in its growth. All the profit in feeding animals must come from the surplus of food given above what is necessary to repair the waste of the system.

(4.) One of the purposes of food is to produce heat, and shelter is usually cheaper than food. For the same reason it is wise to fatten farm animals as far as possible in warm weather, when but little of the food will be required to maintain vital heat.

(5.) An animal to be thrifty must be comfortable ; therefore, a good bed and kind treatment are equivalent to food.

5th. In order that animals should be managed so as to increase the fertility of the farm, requires that the pastures be not overstocked, for there must be grass enough for full feed and some left on the ground. The stock must not be allowed to roam over the farm in winter and early spring, wasting their manure and injuring the land by tramping it when wet.

The manure made must be protected from loss by leaching or firing, and applied to the soil in the way that will secure the best and most lasting results. It is a wonderful and beneficent arrangement of Providence that the waste and offensive

matter of the farm may be transmuted in the soil into golden grains, luscious fruits, and palatable and nutritious vegetables; that the vegetable matter decaying on the surface, or in the soil, should furnish the elements necessary to produce the plants that are to follow. The poet says:

“Life evermore is fed by death,
In earth and sea and sky;
And that a rose may breathe its breath,
Something must die.

Earth is a sepulcher of flowers,
Whose vitalizing mould
Through endless transmutation towers
In green and gold.

The oak-tree struggling with the blast
Devours its parent tree,
And sheds its leaves and drops its mast,
That more may be.”

On the farm the offensive poisonous excrement, which, if allowed to accumulate would contaminate air and water, and the decaying vegetable matter are vitalized and utilized in the soil, so as to give health and wealth to the farmer who uses them intelligently.

Stock Growing on High-priced Lands.—It is thought by many farmers that to make stock growing profitable, cheap lands are necessary, and that this branch of farming is only suited to a new country, or broken lands unsuited to the plow. I believe that on farms suitable for grain growing, and which are worth one hundred dollars or more per acre, by intelligent management stock growing can be combined with the production of grain, so as to give a greater profit with less labor, and a much better condition of soil, than would be possible if grain alone was produced. I give below the views on this subject of Mr. Chambers Stewart, a farmer now over eighty years old, who has spent his life on a farm such as I describe, and whose success gives weight to his words.

“The greatest distinction conferred on man at the creation was dominion over all things, animate and inanimate. Invested

with this grand heritage, how to obtain the fruits of the earth and subordinate to his use the animals necessary to his subsistence and comfort, must have been one of the first questions that occupied his mind; and now, after the lapse of ages, we are engaged in the study of precisely the same question. How shall we make the most of the gifts of a munificent Providence? Can stock growing as a part of our mixed husbandry be made profitable on our high-priced lands?

“There are those with whom it has become a conviction that stock growing is not a paying business, and who do not propose to raise even the horses required to cultivate their own farms. Our railroads, furnishing a cash market for grain at every depot, have induced many of our farmers to devote their lands almost entirely to the production of grain to be sold. Farms of very rich soil may endure this incessant plowing for a time; but already we hear of farms that are growing poor and unproductive. For a man to so cultivate his land as to be obliged to admit that it is growing poor under his management, is to exclude himself from the number of those who may be called good farmers. We believe farming on land worth one hundred dollars per acre may be so conducted as to make it a reasonably lucrative occupation, and at the same time the fertility of the soil be retained and even improved. But we also believe this can only be done by making stock growing a part of our mixed husbandry. This can only be done by having good stock and keeping it well.

“In stock growing there is an opportunity offered for every one to consult his taste, or, if you choose, his talent. Some men have a talent for producing a superior quality of a certain kind of stock. Let such cultivate their talent. A higher degree of success is often attained by making a specialty of one kind of stock. I believe, however, the average farmer will do best to raise and keep a variety, and in this way the various products of the farm can be utilized with more economy and greater profit. If one has a taste for sheep, they may be kept with profit, especially if a large portion of the farm be of broken land or thin soil. The breeding and feeding of hogs has been

a source of wealth to a large number of farmers, notwithstanding some losses from cholera.

"In determining the relative profits of the several products of our farms or of a single product, we must take a series of years, and the farmers who have adhered to the business of raising and feeding hogs have found it profitable. While this business is so generally and so well understood, I will venture the single criticism that as a rule hogs are kept too exclusively on corn, and would do better to use more grass and clover.

"I have said we must have good stock. In most localities where hogs are a leading product of the farm there has been such marked improvement that but little trouble or expense will be required to furnish the farmer with a good stock of hogs.

"As regards cattle, the case is different. The farmer who keeps five or six cows, will say he can not afford to buy a thoroughbred short-horn bull; but five or six farmers living on contiguous farms can unite in the purchase of one. In my neighborhood there are two groups of farmers operating on this plan. The sire should be changed once in three years, and at the end of twelve years most of the stock on these farms will be seven-eighths and fifteen-sixteenths short-horn. These would be called high grades, and are as good for grazing and feeding as the thoroughbreds. Men largely engaged in raising and feeding cattle find from experience that the grain and grass that will grow two hundred pounds on a scrub steer will make three hundred pounds on a high grade. My own experience and observation assure me that the same treatment which will make a scrub steer weigh twelve hundred pounds at three years old, will bring the high grade to fifteen hundred pounds at the same age, and the grade will bring five cents a pound as readily as the scrub will four. One is worth seventy-five dollars, the other forty-eight. This illustrates the difference between the highly improved and the common, in all the meat producing animals. It is easy to see that there may be a profit in one when there would be none in the other.

"I believe it is only those who have been raising stock of an inferior quality, who think there is no profit in stock grow-

ing. In horses the difference in quality makes a much greater difference in value than in other stock. I think every farmer who owns eighty acres of land might find it profitable to have one good brood mare. Let her be large, strong, and handsome; if she is well bred and suitably mated, he may expect valuable progeny. When not breeding she will be as good as any horse for work, and even when raising a foal, may perform a great deal of service. In this way the farmer can supply his own wants and occasionally have a horse to sell.

“There is another class of horses that is in great demand and at high prices, which, if a man has taste, judgment, and skill in breeding and training, may afford a greater profit. They are large, handsome, and elegant horses that travel well, among horsemen formerly called harness-horses. They are now more frequently called coach-horses, and are adapted to the gentleman's family carriage, the omnibus and express wagon, and are the best for general purposes. For several years past there has been an active demand for horses of this class for exportation. The farmer who has mares adapted to breeding such horses, by mating them properly may do a large proportion of, if not all, the work on the farm with these mares and the three and four year old horses of their produce. It is better for horses of this age to be worked on the farm for two years. They make better horses. They are better trained and more reliable, and at five or six years old sell readily in the market at good prices, and are, I think, the most profitable horse for the farmer to raise, because he can make the colts pay their way at work from the time they are three years old until they go to market. I would allow the farmer to feel a just pride and ambition to produce a team that will draw the plow at the depth of six inches from morning to evening and from day to day; a team that can be relied upon at all times and under any circumstances to move a load if it is in their power.

“A slight modification of this class by taking the lighter mare (lighter because they have been bred with a larger infusion of pure blood) and breed these to the handsome and well-bred trotter, and you may hope to produce as good a roadster

as any one; an active, light-footed horse, with spirit and mettle disposing him to promptly respond to every call, and seem delighted to accommodate you with any rate of speed down to 2.40, if you choose, with ease, grace, and elegance in every movement; one that will occasion persons meeting you to look back just to enjoy the poetry. To sit behind such a horse helps a man's digestion, and to produce such a one is just as laudable an ambition as to make improvements in mechanics.

"And here I am willing to record my protest against the overshadowing consequence given by nearly all our live stock journals and agricultural boards to the mere trotter. The horse that can go his mile on a track as smooth as can be made, attached to a vehicle as light as can possibly be constructed to carry the weight of one man, and can come out two seconds ahead, without regard to size, form, or color—that such a test should be regarded as a standard of merit, is, we think, an absurdity. But it is not so much to the trotter that we object as to the undue space and consideration given this class in our papers, and the disproportionate awards by our agricultural boards. We believe it is exceedingly doubtful whether this course has resulted, or will result, in any material improvement in our roadster horse. It leads to the neglect and under-value of qualities other than mere speed at the trot. While the cultivated æsthetic taste of men, women, and children is ever ready to proclaim a thing of beauty a joy forever, we should cultivate beauty and docility, and this can be done without sacrificing any other desirable quality.

"We have said something of the kind and quality of stock that we think may be produced with profit, but this will depend entirely on the treatment it receives, and to insure success the first and indispensable thing to be done is to provide an abundance of pasture. We recognize the red clover, mixed with timothy, as the grand fertilizer and renovator of our fields, and at the same time it furnishes the largest amount of pasture; and we hold that the management that secures the largest possible amount of benefit to the stock is entirely consistent with a large benefit to the soil. The stock must have an abun-

dance and some left; reduce the number of stock rather than fail in this. Have some left to protect and encourage the growth of the roots. It should be allowed to grow in the spring until a considerable portion of the clover is in bloom, and it may be so managed that a portion will be in bloom all season. On almost every farm there may be some permanent pasture. All good clay limestone land will produce bluegrass. Timber land where the timber is not too dense, hillsides that would soon become poor if plowed much, corners cut off by a ravine, if well set in bluegrass and properly managed will afford a great deal of pasture. It enables the farmer to alternate, to have some growing while some is being eaten down. If this variety of pasture is provided, stock can be carried over a much greater portion of the year on pasture, and there is no feed equal to good pasture for young stock.

“The treatment of stock during winter should be made a study. To carry stock through the winter it should be classified. The younger and weaker should be separated from the stronger, and very special attention given to the young. An old and successful farmer and stock grower once made a single remark to me, when I was yet quite a young man, that has been worth more to me than the reading of some volumes. He said, “Do not forget that every young thing needs nursing,” and he intended the remark to apply to plants as well as animals.

“Young, growing stock should have such care, attention, and feed, as will secure a constant, uninterrupted growth, winter and summer. Nature demands this, and if from any cause growth is suspended for any considerable time, loss and injury are sustained. This is especially true of the meat-producing animals that are sold by weight. Whatever these animals may eat during the period that growth is intermitted is more than a clear loss. The disposition to take on flesh and mature early is injured. And now I do not think I am putting it too strongly when I give it as an opinion that one-half of the young cattle stock will from year to year weigh more on the scales in the month of November than they will the following April. If children were treated in this way—if their diet, clothing, and

lodging were so unsuitable as to entirely suspend growth for five months in the year, and this continued from year to year—the consequences would be ruinous. Protection from the rigors of winter, ample provision of suitable food, strict care and attention that this is given them regularly and with economy, is an absolute necessity. A good authority on the subject has said, ‘Be diligent to know the state of thy flocks and look well to thy herds.’ All this is a condition of success.

“In farming, especially if stock growing is included, as in every other business or profession, a man who has a taste and love for it, who takes into his business some degree of enthusiasm and a purpose, if possible, to excel, is the man most likely to succeed.

“Let us congratulate ourselves that ours is a mixed husbandry. Favored with a great variety of soil and climate, we can successfully cultivate a great variety of crops, and breed and rear all the domestic animals necessary for our use and comfort. Our occupation, thus varied, is far more attractive, and makes necessary a higher degree of intelligence, and is relieved of the monotony and irksome drudgery that attach to farm life in less favored countries.”

Stock on the farm, intelligently managed, gives a home market for its bulky products, thus making of the farmer a manufacturer, and furnishes the means of enriching the soil and improving and greatly increasing its productions.

The breeding, rearing, feeding, and care of stock will be treated in these pages from a practical stand-point, and I shall avail myself of all the help I can get from practical farmers, believing that a record of successful management will be of greater benefit to our readers than histories of breeds, long pedigrees, or fine-spun theories.



LIVE STOCK DEPARTMENT.

CHAPTER I.

THE HORSE—HISTORY.*

THE Fossil Horse.—Paleontology teaches that the horse inhabited America during the post-pliocene period, contemporaneous with the mastodon and *Megalonix*. He was unknown to the natives of America at the time of the discovery of America. Fossil remains, chiefly molar teeth, have been so frequently found on the plains and plateaus of the Southern States, and in Central and South America, and have been so carefully identified by such paleontologists as Dr. Lund, Professor Owen, and other competent paleontologists, that there is no longer room for doubt that the horse found existence in the Western world congenial to his nature.

Though the vast plains of the Northern and Central and Southern divisions of the American continent are perfectly adapted by climate, soil, and products to the necessities of the species, no single living specimen was found by the Europeans in America. The rapid increase of horses, that swelled into vast herds on the plains and plateaus, shows how well adapted is this country to the production of the species.

Just when, in the past geological periods, the horse became extinct as a living fauna, would be interesting to know, but as yet science has not revealed it to us. The broad plains of both continents seem perfectly adapted to the necessities of the genus *Hippus*, as is proved by the readiness with which the individuals that have escaped from the control of man have been speedily succeeded in their wild homes by vast herds of wild horses. Science has failed to show that the specimens of the fauna of

* Contributed by L. N. BONHAM, Agricultural Editor Cincinnati *Commercial*.

the periods which produced the fossil horse have escaped the fate of its contemporaries, the mammoth or mastodon, and we are left to surmise only as to how and where the horse of to-day originated, unless we accept the solution offered in Mosaic history. The preservation of the species by means of the ark is corroborated by circumstances attending the propagation and dissemination of the horse of ancient and modern times.

That the plains of Southern Africa are more likely to have been the original habitat of the genus *Equus* can not justly be inferred from the better adaptation of the soil and climate of that region to the existence of the horse, since the rapid spread and successful, healthful growth of the animal in the wild state on the plateaus of the Western continent, show the perfect adaptation of soil and climate and produce in the Western home to the wants of the species. From the few horses which escaped from the discoverers of America have, in a short period, sprung as by magic, such vast numbers of powerful and hardy animals, that the wants of their nature are as fully met as on the plains of Africa. It is a question, then, of time, of beginning, or appearance of individual specimens of the species on the plains of Africa and America, and not of unfitness of the West as an original habitat.

The history of the horse in Africa goes not farther back than the Flood of Genesis. Assuming what seems most probable, in the light of Scriptural history and absence of any clearly arranged chain of scientific records to the contrary, that the horses of ancient and modern times have proceeded from the individuals that escaped destruction in the great Flood, there are good reasons for belief that the plains of the Eastern continent have been dotted and grazed by the descendants of the specimens which escaped on Ararat. Until a more rational and scientific explanation of the origin of the horse appears, we are compelled to conclude that the horses of the Eastern and Western Hemispheres have descended from the remnant remaining somewhere on the Eastern Hemisphere.

In speaking of the history of the horse, Colonel Hamilton Smith, in Vol. XII of the Naturalist's Library, says: "We know

so little of the primitive seat of civilization, the original center, perhaps in Bactria, in the higher valleys of the Oxus, or in Cashmere, whence knowledge radiated to China, India, and Egypt, that it may be surmised that the first domestication of the post-diluvian horse was achieved in Central Asia, or commenced nearly simultaneously in several regions where the wild animals of the horse form existed. The fossil beds of New Mexico, Utah, and Wyoming belong to the eocene period, and furnish us fossils of the earliest forms to which the modern horse can be traced. This would indicate that the horse inhabited America before Asia or Africa, as similar evidence can not now be shown in favor of their being the ancient habitat of the horse. Yet this is not proof to the contrary, since paleontologists have not explored the immense tracts of older Asia and Africa as they have this newer continent."

On this subject the *American Cyclopædia* says: "The *E. neogeus* (Lund), and *E. Major* (De Kay), two species of the closely allied genus *Hipparion*, and one of the *Hippotherium*, indicate that the equine family were well represented in America in former geological periods. Whether this ancient horse, of about the same size as the recent one, and distinguished by the usually more complex folds of the enamel of the molars, became entirely extinct before the creation of man, may admit of question." Professor Leidy says, "There is no room to doubt the former existence of the horse on the American continent at the same time with the mastodon, and that 'man, probably, was his companion.'" The fossil horse has also been found in the Old World in the pliocene of Europe with the mastodon and tapir, and through all the diluvial period, and in the upper tertiary of Asia; there are two or three species described in Europe and as many in Asia. From this it appears that the horse inhabited the Old World, as well as the New, before the advent of man, while others persisted in a declining condition during the early part of the human epoch.

Written History.—EGYPT THE PRODUCER OF HORSES.—The earliest writings pertaining to the horse are of Sanskrit origin. The hieroglyphics of Egypt show that Egyptians used

horses to chariots and for riding, but not for labor in bearing burdens or drawing the plow. There is little doubt that the horse was domesticated among Egyptians two thousand years before the Christian era. The Hebrews furnish the world the earliest written accounts of existence and use of horses. Stonehenge says: "The earliest record of the horse which we possess is in the Old Testament, where we first find him inferentially mentioned in the thirty-sixth chapter of Genesis as existing in the wilderness of Idumea about the beginning of the sixteenth century before Christ." But 1650 B. C., Joseph proceeded from Egypt into Canaan with his father's body, accompanied with chariots and horsemen, which shows that horses had at least become recognized as valuable among men of high rank. But as they had long been used by Egyptians for war purposes before they were used in pageants and as a means of transportation, their use dates further back than 1600 B. C.

Lenormant dates the introduction of the horse into Egypt at the time of the "Shepherd Kings," 2200 B. C. We may safely say that the horse has been an important factor in civilization four thousand years. What civilization would have been without the horse is difficult to imagine. Professor Brewer says: "The higher the enlightenment of a people, the greater the variety of uses to which horses are applied." In the earlier civilizations the ass, the ox, the sheep, and even the dog, figured on their monuments before the horse was recognized of great public value. Even among the Assyrians and Phoenicians the horse appears to have been subordinate in rank to the ass, ox, and sheep. Egyptian civilization gave him a place on monuments and works of art some five hundred years before he was alluded to in the writings of the Israelites. They spoke of the horse as belonging to their enemies. Pharaoh is recorded as taking "six hundred chosen chariots, and all the horses," in his pursuit of the Israelites to the Red Sea. Notwithstanding the fact that in the history of Arabia, it has become most noted as the home of the Arab horse, yet, while the Israelites wandered there, we find an entire omission of record to show that there were horses used by this peculiar people. Even six hundred years later, Stone-

hence says, "Arabia could not have been remarkable in any way for her horses; for Solomon, while he resorted to her for silver and gold, mounted his cavalry from Egypt."

The Israelites were, indeed, a peculiar people, viewed in the light of the civilization of the nineteenth century; for they even hamstrung the horses of the Canaanites, which fell into their hands. They were able to drive out the inhabitants of the mountain, but could not drive out the inhabitants of the valleys, because these had chariots of iron. (Judges i, 19.)

The Lesson of History.—Thus we have the lesson of history begun, that the people who fought with horses could not be conquered by those who owned not cavalry.

The Israelites became possessors of a hill country, where horses and chariots could not be employed. This was 1443 B. C. A few years later we find in Deuteronomy the order, "But he [their chosen king] shall not multiply horses to himself, nor cause the people to return to Egypt to the end that he should multiply horses." This warning shows that about 1450 B. C., kings were accustomed to make themselves strong by multiplying horses and chariots, and that Egypt was rich in horses, and had them to sell to princes who would increase their power by well-appointed cavalry. Though Egypt was rich in horses, we may not infer that it was the native land of the horse. The presumption is rather that Egypt was more advanced in civilization and the arts and agriculture, and had learned much of the value of the horse as a means of gain and power.

Youatt, in an early edition of his book, was inclined "to trace the first domestication of the horse to Egypt;" but later, on further investigation, he adopted the opinion of Colonel Hamilton Smith, "that it took place in Central Asia, and, perhaps, nearly simultaneously in the several regions where the wild animals of the horse form existed. From the higher valleys of the Oxus, and from Cashmere, the knowledge of his usefulness seems to have radiated to China, India, and Egypt." "The original horse of the Southern and Western countries came from the north-eastern part of Asia, the domicile of those who escaped from the ravages of the Flood." "To ancient Egypt we appear

to be indebted for the first systematic attention to reviving and improving the breeds of horses. Numerous carved or outlined pictures represent steeds, whose symmetry, beauty, and color attest that they are designed from high-bred types."

Egypt seems to have taken the lead of all other nations in breeding and propagating horses. We do not find, however, any authority supporting the view that the Egyptians first tamed and brought the ass or horse into use for riding or drawing chariots in war. Her civilization and higher cultivation of the soil and the arts of husbandry, however, gave special facilities for breeding and rearing horses, and her commerce facilitated the dissemination of them among the nations that came to her for supplies.

The Hebrew Horse.—THE HORSE POTENT IN CIVILIZATION.—The Hebrews make record of horses owned and used by the kings, five hundred years after they were common among the Egyptians. The learned Dr. William Smith says, "David first established a force of cavalry and chariots after the defeat of Hadadezer (2 Sam. viii, 4), when he reserved a hundred chariots, and, as we may infer, all the horses." From Sam. xvi, we may infer that Absalom was the possessor of horses. But not until the days of Solomon do we find that the Hebrew leader found it convenient to disregard the orders in Deuteronomy, and multiply horses to himself, and draw his supplies from Egypt. His kingdom had come to embrace all the land from the river Euphrates to the land of the Philistines, even to the frontiers of Egypt on the south. He had grown so strong as to have the kingdoms of Syria, Damascus, Uwat, and Ammon for his tributaries. But from these he did not obtain his "forty thousand stalls of horses for his chariots and twelve thousand cavalry horses," but such war supplies he drew from Egypt; and the sacred historian says in these days of Solomon. "Judah and Israel dwelt safely, every man under his vine and under his fig-tree, from Dan even to Beersheba." Thus the possession of horses gave security to that people. All history shows the value of horses as an element of strength in a nation's resources.

The Tartars and the Bedouins have been the scourge of nations in proportion as they had horses. "By the horse and on the horse Mohammedan conquests were made." The Israelites only followed the law of national development when they added the horse to their possessions of asses and cattle. Like the nomads of the plains in America, they were feeble to resist or invade until they got unto themselves horses. Our Indian tribes before 1795 had only dogs as their beasts of burden; but after they began to draw horses from Mexico, these wild men of the plain were metamorphosed into horsemen; and of their power for evil ever after, the history of our frontier attests. The nations and tribes in history were feeble and little to be feared until they got unto themselves horses. The horse has been adopted by nations in their progress into civilization.

The Greek Horse.—A GREAT FACTOR IN CIVILIZATION.—On this principle we find the Greeks become powerful as they possess horses. So great is he as a factor in civilization, 1500 B. C. horsemen in the chase and war were seen in the paintings of the palace of Nimroud, which are supposed to be coeval with the siege of Troy. The horses first used by the Greeks were small. Those of the Quirinal are mere ponies, in contrast with the human figures in same paintings. As the Greeks advanced in power, we note their increased use of horses. In their early history, the horse was only used for riding. Then neither bridle, saddle, nor whip was used. The chariot was long in use in Persia before in Greece, and the Greeks employed the chariot in their great games long before they did in war. In the age of Phidias it is evident the horse was held in high esteem. The statues, coins, engraved gems, bas-reliefs, and other works of art that have come down to us, show that the Greek horse could not have been speedy as the English thoroughbred or the American trotter. We know this from the form given in their ideals. Their bodies were compact, neck and shoulders heavy, buttocks round and short, while we never see a speedy animal without the long sloping shoulder-blade, the more open flank, and the longer hip. On the Elgin marbles, or portion of the frieze of the Parthenon now in England, may be seen over

two hundred representations of horses. In the art school of Yale College, there are casts of twenty-eight horses, representing the ideal horse of the third century before Christ. They are small, tough, muscular beasts, all dish-faced like the Oriental breeds of modern times. The representations of horses of ancient Egypt, Assyria, and Phœnician art are of similar type.

It is an interesting fact, too, seen in all these ancient works of art, that in the attitudes given the figures, there is not one trotting, but ambling, or, as we say in the West, pacing, and running. The pacing gait suited best peoples and tribes who used no stirrups, and did not drive in vehicles or trotting wagons. Greek art, then, tells us more than of the form and trappings of the horse; it also tells of the gait and how he was ridden. This ambling gait was the ideal for eight centuries before the Christian era. The later works of art may have but followed the style of the masters, which is more probable, than that ambling and running were the only two gaits of the horse during the history of Greece. Professor Brewer teaches this, and in speaking of the horses represented in the earliest Egyptian, Assyrian, and Greek sculptures, says: "However much the individual animals differed, or even the breeds differ, the most prized animals, as a whole, were strong rather than swift, heavy for their height, with heavy necks, broad chests, and well-rounded buttocks."

As the civilization of the Greeks rose above that of preceding and surrounding nations, we would expect to learn more from writings of Greek authors and artists concerning the horse, not only in Greece, but also in other parts of the world.

Improvement of Horses Came From Egypt.—The improvement of the horse in Greece came with the colonies of Egyptians that emigrated into Greece. The first colony that came about the time of the birth of Moses, while the Pharaohs were in power, settled in Thessaly, in the north of Greece. The soil and produce of Greece were not favorable to production of best horses. Thessaly abounded in rich pastures and pure waters. The Thessalians, after the emigration of Egyptian colonists, excelled as breeders of horses. As about this time horses became

a recognized factor as a means of defense and offense, horse-breeding in Thessaly became a matter of profit.

Instead of using the horse for breaking the ground and preparing for crops, the Egyptian colonist's first business was to rid the forests of wild cattle and other dangerous beasts. In this way the horse became most useful as a hunter.

Horse-races Instituted.—As the next step in his improvement, horse-races were instituted. These races gratified the pride of owners, and gave zest to public spectacles. Soon followed those most celebrated at Olympia in the Peloponnesus, in honor of Jupiter. The feats of horsemanship, accompanied by manly exercises, drew multitudes from all parts of Greece. This, with similar games in other districts, stimulated horsemanship and athletic exercises, which were so liberally rewarded and honored by the government as to strengthen love of country, for which the Greeks became distinguished. In the course of one century the wrestlers and runners and boxers gave way to the horsemen and steeds, who alone appeared at this national contest. Each horse was ridden by his owner. The space to be run over was four miles, which was designed not only to test the powers of endurance and speed and training of the horses, but also the horsemanship of his owner. In the twenty-fifth Olympiad the horse first appeared in chariot-races.

Endurance and Docility Sought.—The endurance and docility of the horses and skill of the driver were severely tested, as the course was one-third of a mile, at the end of which was a pillar, around which the horses were sent at full speed and back over the course six times. It was a severe test of skill of driver and of docility of the horses. Near it was the enormous and horrid statue, called Taraxippus, the terrifier of horses. A little further on, in the center of the course, was a defile, between rocks, on which a group of men with blaring trumpets tested the courage of the steeds. The unfortunate and wrecked teams and drivers, of which there were many, were jeered by the crowds of spectators. The crown of the victor was hardly earned in such a fearful contest. But these national games, in the course of one century, became grand tournaments of horse-

manship. The finest horses of Greece and Thessaly, and even neighboring countries, competed there, and the athletes and boxers of the earlier times were wholly superseded by the general interest in the more powerful animal, the horse. Orators, poets, sculptors, and painters eulogized and extolled his power and form, by eloquence, poetry, and art. When a nation should in a short century become entranced with admiration of the horse, his improvement must be marked. The Greek ideal of the horse impressed itself on all the nations brought under the influence of Greek civilization.

The Olympian Races Lead to Improved Breeding.—If we consider the rank the Olympic games had attained, while only athletes appeared in the games, and then reflect that when the improvement of horses in Greece had become of so grand proportions that princes and kings and men of highest rank and wealth expended fortunes in obtaining and fitting their horses for these contests, we may get a partial view of the esteem in which breeding of good horses was held in Greece. Homer has many examples wherein princes, heroes, and great men distinguished themselves in the handling of horses and the chariot.

The owners were persons of considerable rank. Kings themselves aspired to the glory of the victor at Olympian races, and considered that the Olympic palm added new dignity to the splendors of a throne. Gelon and Hiero, kings of Syracuse, and later Dionysius, were among the competitors. In the *Electra* of Sophocles we have a vivid description of a chariot-race run by ten competitors. In the twelfth and last round, Orestes, having only one antagonist left—the rest having been thrown out—broke a wheel against the boundary, and was dragged by his horses and torn in pieces. Philip was equally delighted by three couriers bringing him advices at the same time; first, that the Illyrians had been defeated by his general Palermo; second, that he had won the prize at a horse-race in the Olympic games; and third, that his queen was delivered of a son. When Hiero sent horses to these races he caused a magnificent pavilion to be erected for them. History tells us that no one ever

carried ambition to display at the public races of Greece so far as did Alcibiades. He distinguished himself by the great number of horses kept only for the races. He sent seven chariots at one time to the Olympic games, at which contest he carried off the first, second, and third prizes. This victory had never been equaled, and was the theme for a celebrated ode by the distinguished poet, Euripides.

The interest aroused among citizens of Greece and neighboring countries by these feats of horsemen and their teams of two, three, and four trained horses, is manifest by artists and poets, while statues were erected in honor of the victors, and even of the horses.

A Monument to a Mare.—In the sixth book of Pausanias we are told of a monument erected in honor of the mare Aura. Her rider having fallen off at the beginning of the race, the mare continued to run as if he had been on her back. She outran all competitors, and at the final sound of the trumpets, near the close of the contest, she rounded the goal as if conscious that she had won the race, and presented herself proudly before the judges. When we consider that these games were attended by the flower of Greece, and that the audiences were entertained by the finest orators, historians, and poets the world had then produced, we can appreciate to some extent the impetus that must have been given to the business of breeding and training a class of horses possessing the style, speed, docility, and endurance demanded in the contestants of these world-renowned games. Herodotus read his history at these games to all Greece. His contemporary, the famous Athenian orator, Lysias, chose the occasion of these games to congratulate the Greeks on the reconciliation of their States.

The Greek Horse Improves those of Southern Europe.—I have enumerated some of the influences in Greek civilization that led to the improvement of the horse in the southern part of Europe. The type of horse developed in Greece became that of Eastern Asia, Thrace, Macedonia, and the more distant countries bordering on the Mediterranean Sea. Wherever the commerce of Greece extended, it carried a knowl-

edge of a mighty people, made more powerful by her ships and horses. A better knowledge of the history of the nations bordering on the Mediterranean, doubtless, would show that the influence of the highly bred horses of the Greek Empire has improved the horses of every land in Southern Europe that has felt the elevating power of Greek civilization. The language, customs, and learning of the Greeks had much to do in improving the people of the Roman Empire, and the ideas and tastes of the Greek manifested themselves among the Romans in their religion and games, races and feasts, art and literature; their highest attainments in art, oratory, poetry, agriculture, horsemanship, and seamanship became models for the Roman people.

The Ideal Greek Horse was described by Xenophon in a masterly manner, and we find in the writings of T. Varro a description of a horse so like that of Xenophon's ideal that the Roman must have been familiar with the writings of Xenophon; and as each wrote the best description of the horse of his day and country, it is a reasonable inference that the ideal of

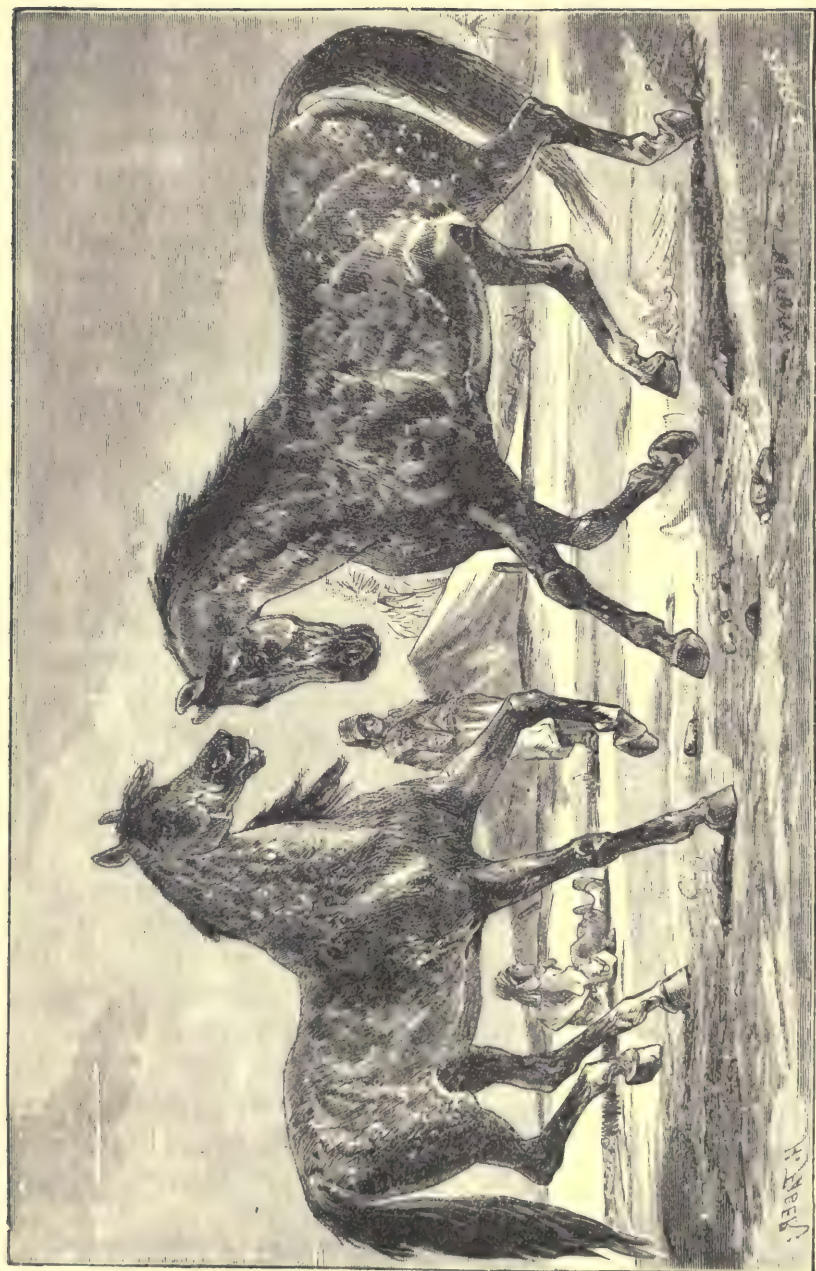
The Roman Horse was not very unlike that of the Greek. Varro says: "We may prognosticate great things of a horse if, when running in the pastures, he is ambitious to get before his companions, and if coming to a river he strives to be first to plunge into it. His head should be small and bony, his limbs clean and compact, his eyes bright and sparkling, his nostrils open and large, his ears placed near each other, his mane strong and full, his chest broad, his shoulders flat and sloping backward, his barrel round and compact, his loins broad and strong, his tail full and bushy, his legs straight and even, his knees broad and well knit, his hoofs hard and tough, and his veins large and swelling over all his body." This was written in the century before Christ. Virgil, in the century after Christ, speaks in his florid style of the horse taken from pursuits of war, and his powers turned to the advantage of agriculture.

Had not the irruptions of Goths and Vandals, soon after, swept away every record of science in the Eastern and Western Hemispheres, the history of the development of the horse in Southern Europe would not have been so unsatisfactory as it is.

Roman Horse Inferior to the Greek.—From the history of the Roman Empire we find that, while the people learned much from the civilization of the Greeks in the way of art, poetry, and oratory, they did not profit by the example of the noble Greek in the improvement of horses. They imitated the games of Greece, so far as they were theatrical and spectacular entertainments, but they lost the central idea of the later Olympiads, where the Grecian games were made to develop the speed, docility, and endurance of the Greek horses. Italy may be unfavorable in climate and soil, and this may be another cause for the Roman cavalry always proving inferior to that mustered by their enemies in Macedonia, Thessalia, Epirus, Parthia, and farther east and north.

Cæsar, with the cavalry he had drawn from Gaul, easily rode down that of Pompey, drawn from Italy. During the dissensions that wrecked the empire the best cavalry was made up of horses from bordering tribes and nations. After conquest became the ruling idea in the Roman Empire, agriculture in all its parts declined, and the Romans procured better horses for cavalry from surrounding provinces than could be found in Italy. The intelligence of a people, in the case of the Romans, does not seem to be as important a factor in the development of the highest type of horses, as do the agencies of food, climate, and soil, and the peaceful pursuits of agriculture.

The Arab Horse illustrates this. The devotion of the Arab to his horse atones for the want of fertile fields and abundant stores for the support of his horses. Barley and straw and milk form the diet of the horse of the Bedouins, Mamelukes, and Arabs. But these are not the breeders of the Arabians that have had so wonderful an influence on the blood of horses in England, France, and America. Burckhardt says it is a mistaken idea that Arabia is very rich in horses. The breed in that country is limited to the extent of its fertile pasturing districts, and it is in these parts only that the breed prospers; while the Bedouins, who are in possession of poor ground, seldom possess any horses. We, therefore, see that the tribes richest in horses are those who dwell in the comparatively fertile



ARABIAN HORSES PRESENTED TO GENERAL GRANT BY THE SULTAN OF TURKEY.

plain of Mesopotamia, on the borders of the Euphrates, and in the Syrian deserts. It is there the horses can feed, for several spring months, upon the green grass and herbs of the valleys and plains, produced by rains which seem to be an absolute requisite for its reaching its full vigor and growth.

The Origin of the Arabian Horse.—Buffon and many subsequent writers claim that Arabia is the birthplace of the horse. Stonehenge, with a learned following, does not agree. He thinks the dry nature of the country and the scantiness of herbage show that in a wild state the horse could hardly exist there, and that it is only by the care and superintendence of man that the Arabian horse has become famous. The conditions of the climate surely favor hardy growth, and the concentrated, aromatic grasses and herbage of that country favor better development of bone and muscle than do the more succulent grasses of a damper climate and richer soil like that of Italy.

Low, in his great work, attaches great importance to the agencies of food and climate in the development of the horse. "There may be other causes unknown to us." The "other causes" are as yet the unknown quantity in the problem of the existence of so grand a breed of horses in a seemingly infertile, austere country, among a semi-civilized people. While the people have, in the last seventeen centuries, declined below the average of the nations of the East, their horses have been models of style, fleetness, and endurance for centuries. It is probable they drew their first good blood from the famous studs of Solomon, and their almost superstitious devotion to the horse, coupled with the salubrity of the atmosphere and the fragrant and concentrated nature of the grasses and herbage and food, together with their singular fidelity to pedigree and care in breeding, have evolved the wonderful Arabian horse. Similar influences combine in the ancestral history of

The Barb, to make it one of the most valuable breeds the world has known. The barb is of Arab stock. The Arabs now found in Barbary are emigrants. It includes that northern part of Africa extending along the coast of the Mediterranean, and inland to the great desert, from the

frontiers of Egypt. Bruce writes that "the best African horses are said to be descended from one of five, on which Mohammed and his four immediate successors fled from Mecca to Medina, on the night of the Hegira." Youatt says, "The barb alone excels the Arabian in noble and spirited action; but if there is a defect in the barb, he is perfect for that which he was designed. The barb improves toward the western coast of Africa, both in his form and graceful action." The Arabs found in Barbary are descendants or emigrants from Eastern Arabia. "The horses are likewise all of Arab stock considerably modified by change of climate, food, and management."

Berenger furnishes the following description of a true barb: "The neck is long, slender, and ill-furnished with mane, but rising distinctly and boldly out of the withers; the head is small and lean; the ears well-formed and well-placed; the shoulders light, sloping backward, and flat; the withers fine and high; the loins straight and short; the flanks and ribs round and full, and with too much bend; the haunches strong; the croup, perhaps, a little too long; the quarters muscular and well developed; the legs clean, with tendons boldly detached from the bone; the pastern somewhat too long and oblique; and the foot sound and good. They are rather lower than the Arabian, seldom exceeding fourteen hands and an inch, and have not his spirit or speed or continuance, although in general form they are probably his superior."

The barb is the chief element of excellence in the Spanish horse, and was at a very early period of systematic improvement of the English thorough-bred introduced into England. The Godolphin Arabian was a barb, and to him traces some of the best racing blood in England. The Barbary and Arabian horse are found on the south of the Desert of Sahara, among the inferior tribes. These horses are "small, weak, unsafe, and untractable."

Horse Degraded With Man.—As we go to the west, along the African coast, we find fewer horses, and greatly inferior in form and quality. It is worthy of note here, that as

we have descended the stream of time, and along the course of the emigration of the Arabs, with their horse, bred from their best ancient stock, from the plains east of Egypt to the country along the coasts of Africa, that the people and horses decline in courage and value as we approach the African slave-trade region. Some of the tribes neighboring Egypt will not own a good horse, or if they should, they deform or injure it to prevent the Egyptian and Turkish tyrants from robbing them of their horses. The improvement of the breeds of horses seems to be influenced by the liberty and independence of the people as well as the character of soil and climate.

Although the Arab horse and his descendant, the barb, have done so much for the improvement of the horse of modern times, it is not capable of proof that, in very early times, the horse could be found in Arabia. Solomon imported spices, gold, and silver from Arabia, but not horses. He procured them from Egypt, which at that time led the world as a civilized power. Egypt exported horses into Arabia as presents to reigning monarchs. In the fourth century the Roman Emperor sent two hundred Cappadocian horses as a present to a powerful prince in Arabia. As late as the seventh century the Arabs must have had few horses. Mohammed could muster only two horses when he attacked the Koreish near Mecca; nor did he get a single horse from the vanquished.

The history of the horse in Barbary shows that, though the common horse of that country is a very inferior animal, just such as years of debasement and degradation of a nation must produce, yet the infusion of Arab blood in the best parts of the country has produced a vast improvement. Those about Morocco, Fez, and the interior of Tripoli are the best. Though rather lower than the Arab, seldom exceeding fourteen hands, the general form is thought by many superior to the Arab, yet they lack the courage, spirit, speed and endurance of the best Arab.

Influence of Barb on Arab and English Horse.—

The Godolphin Arabian was a true barb, and to him is traced some of the best racing blood in England. The African mares

imported from Barbary into England have been the source of some of the best turf-horses. The males are never castrated. There is about him a sort of religious reverence, as a descendant from the five which Mohammed escaped with in the Hegira. "A Mussulman would not mutilate or sell the skin of the beast of the Prophet." This reverence for the valuable horses has done much to improve the race of horses wherever the religion of Mohammed has had power.

The African never rides the mare in war. The Asiatic or Arabian never rides the horse. The reason of this may be found in their different modes of warfare. The Arab is always at war with his neighbor, and plans to take his enemy by surprise. A stallion is not suitable for this, since as soon as he comes into the neighborhood of the enemy, and smells the stale of mares, his shrill neigh tells of his approach. The African fights in an open country, and his approach can be known when afar off; so he must rely on the energy, endurance, and spirit of his stallions. The barb improves towards the western coast of Africa, both in form and graceful action.

Godolphin Arabian.—A brief history of the Godolphin Arabian may be of interest, as his blood is found mingled with that of so many noted racers. He is believed to have been presented to Louis XIV by the Emperor of Morocco. He was so little appreciated in Paris that he was then used in a water-cart. A Mr. Coke bought him, and presented him to the keeper of the St. James Coffee-house, who presented him to the Earl of Godolphin. The horse was used by the Earl as a teaser to Hobgoblin. He was allowed to cover Roxana simply because Hobgoblin refused. The produce of this cross was Lath, one of the best horses of his day. His excellence as a foal-getter proved to be even better than that of the Darley Arabian, imported some twenty years before.

The Darley Arabian.—The Darley Arabian was the parent of some of England's best racing stock. He was purchased at Aleppo, and bred in the desert of Palmyra. Flying Childers and Bartlett's Childers were the two stallions by which the blood and fame of the Darley Arabian became famous. The

blood of the Darley and Godolphin both unite in that of the celebrated horse Eclipse, whose superiority was such that his owner, O'Kelly, placed the wager on "Eclipse first, and the rest nowhere;" or, in other words, the roarer distanced the field. These two horses—Darley Arabian, from the desert of Palmyra, and the barb, called Godolphin Arabian—made such a marked improvement on the English horses of their day that any history of English horses would be most defective without notice of them. I will quote from Stonehenge:

"Pure Arabs are considerably smaller than our modern thorough-breds, seldom exceeding fourteen hands, two inches in height. The head is remarkable for the width across the forehead, which is also full and square, while the muzzle is finer, the face more hollowed out, and the jaws more fully developed in their proportions than any other breed with which we are acquainted. The eye is full and soft, yet sparkling with animation at the least excitement; the ear is small; the neck arched; the shoulders oblique, but muscular; the withers moderately high and thin; the chest rather light in girth, but the back ribs rather deep in proportion; and the hips, though narrow, well united to the back by a rounded mass of powerful muscles; the croup is high, and the tail set on with a considerable arch; the bones of the leg are large in proportion to the size, and the tendons full and free, the suspensory ligaments being particularly clean and strong; the hocks are large and free both from curbs and spavins; and, lastly, the feet, though small, are sound, and capable of bearing an amount of battering which few well-bred English horses can sustain. From the full development of the brain in this breed, it might be expected, *a priori*, that the amount of intelligence and courage possessed by them would be far above the average; and such is the result of experience."

They are generally docile, and have "fine tempers." If, however, they are highly fed, and deprived of the necessary amount of exercise and cruelly treated, their nervous system is so sensitive that they rebel, and when they fight they persevere to the death. "The colors of the Arabian horse are mostly bay, chestnut, and gray, but occasionally black. The skin

itself of the gray horses is of a deep slate-color, and the manes and tails are darker than the rest of the body."

The Origin of the Arabian Horse.—The origin of this wonderful race of horses will probably never be fully known. Many historians accept the tradition that Mohammed, desiring mares for his steed, selected a number from his best cavalry, and kept them two days without water. When frenzied with thirst, they were turned out to water. As they approached the drinking-place, the war-charge was sounded by his trumpeters. Five of the mares abandoned the water, and hastened at once to the spot where the call indicated the excitement of battle. These five mares were selected for the foundation of his royal stud. Oriental travelers assert that pedigrees trace back five hundred years, and even to the time of Solomon. Many ceremonies are performed at the covering of these royally bred mares. "After the birth of the foal, a certificate is made out" in due form, by local authorities, within one week after the foal is dropped.

The Arab Mare as a War-horse.—The mare is highly prized by the Arab, and, as has been said, is used by the Arab in war, he never trusting his stallion in surprising an enemy. For this reason many writers have argued that the Arabs value more highly the qualities of the mare than the horse; but their motto *el hôr ilebal el fahal*—"the foal follows the sire"—does not warrant the conclusion. Under the Laws of Breeding we shall notice this again.

The Unique Character of the Arabian.—The reader who is interested in a fuller history of the horse will find that the Arab horse has given character to the horses of every nation bordering on the Mediterranean Sea and the lands invaded by the devotees of Mohammed. In modern times the English thorough-bred traces many of the best families to the Arabians. What influence the Arabian has had on the celebrated French horses we can not now tell; but that his blood has given character to the noble Percheron and the ancient Norman we can not doubt. The Turkish horse "seems to be merely the Arab developed by higher food into a larger size and more massive

proportions," says Stonehenge. The best horses of Persia are found on the border of the gulf, and their ancestors were brought from the opposite shore of Arabia.

The unique character of the Arabian excites our admiration. Its ability to impress its rare qualities on every other breed on which it has been crossed, we conclude, comes from the fact that for centuries it has been bred with greater care than any other animal that blesses the earth. Its feed and surroundings and use have given stamina and quality. The centuries of kind treatment, which has been a peculiarity of the Arab, have developed a docility without a parallel.

The Thorough-bred.—The excellence of the English and American thorough-bred horses trace directly to Oriental ancestry. The countries which have races most nearly related, and possessing peculiarly valuable characteristics, are Arabia, Syria, Persia, Turkestan, and the Barbary States. We have shown before that, in all these, the Arab and barb have given character to the horses of the East. As England became a power in civilization, and her commerce extended to these Eastern countries, we find her looking to them for blood to improve the English horses, just as did Greece, when she rose to a high civilization, look to the older country, Egypt, for horses to improve the Grecian horse. In the English and American thorough-bred we have the accumulated excellences that have, by centuries of selection and development, arising from improved methods of systematic breeding, centered in the best of the race.

The marvelous tales of travelers, colored by all the imagery peculiar to Eastern and mythical stories, together with the charm of the past and distance, have led many to believe that the Arab has never been equaled. We believe that the close student of the development of the species will find that the evolution of the thorough-bred must go back in history to the Egyptian, thence to the days of Solomon in all his wisdom and glory, thence to the Grecian and the regions where its highest civilization had influence, and thence to the countries bordering on the Mediterranean Sea. Under the wonderful influence of Mohammed the people of the desert country collected and developed

the flower of the race, and the modern civilizations have felt and further developed the power of the well-bred animals, that had made the history of the horse brilliant all along the line of progress of the human race.

The Arab Element.—The history, then, of the thorough-bred is so linked to that of the Oriental horse as to be really lost in antiquity. James I bought of Mr. Markham the first Arab stallion, early in the seventeenth century. Either from national prejudice or lack of merit, this horse, called Markham Arabian, failed to become popular. Charles I gave some attention to the importation of ancient blood; but little was done till Charles II imported, for breeding purposes, animals afterwards known as the “royal mares of the Stud-book.”

The Barb Element.—James II continued importations from the South. The “royal mares,” “to which nine-tenths of our modern thorough-bred horses trace,” Herbert claims, “were Tunisian or Tangier barbs. But the horse of England, before this time, probably, had been improved by ancient blood, brought to the island in the course of the invasions by the Gauls, who ravaged Upper Greece and Northern Italy. Herbert argues that the horses of the earliest times of England were probably improved by specimens of an Oriental race, that came by way of Thessaly, and improved later by waifs from the Numidian cavalry, employed by the Carthaginian Barcas, long before the invasion of Brittany by Cæsar in his Gallic campaigns. Youatt affirms that Cæsar thought the British horses “so valuable that he carried many of them to Rome.” Of course, during the occupation of England by the Romans, the British horse was impressed by the influence of the cavalry of Cæsar, which had been collected from the various parts of the Roman Empire.

The German Element.—After the Romans left England we find the Saxon conquerors giving attention to the improvement of horses, and after Alfred “running horses were imported from Germany.”

Herbert says, “This is the first intimation we have of running horses in England.” It is a fair inference that the German horses presented by Hugh Capet to Athelstan, together with

the blood introduced by the Roman and Gallic horse, improved the horses of England; for they were at this time prized on the Continent. In Athelstan's reign, history tells us, many Spanish horses were imported, which we know were largely imbued with the blood of the horses of the States of Barbary. In 930 A. D., there was a law made to prohibit the exportation of horses, which shows the characteristic desire of the English to hold a monopoly of a good thing.

Spanish, Norman, and Flanders Blood.—William the Conqueror improved horses of his kingdom by the importation of many fine animals from Normandy, Flanders, and Spain. His powerful cavalry gave him the victory at the battle of Hastings; nevertheless, he showed his appreciation of the Southern and Oriental blood by riding a Spanish horse. It will be noticed that, thus far in the history of the horse, his use has been exclusively under the *saddle*, if we except the chariot-races in ancient history.

The Horse in Agriculture.—Under William the Conqueror we find the first mention of the use of the horse for purposes of agriculture. It is well to bear in mind that the ancient historians were monks and priests, and that book learning was largely confined to the monasteries, which will help us to understand how it comes that so little is left recorded about the development of the breed or breeds, and their use as a factor in the development of the nations.

The English Begin to Use Horses.—The Venerable Bede, an English monk, who wrote just after the triumph of the Roman over the Scottish Church, is high authority, and informs us that the English began to use horses as early as 631 A. D. Ecclesiastical history tells us that Alexander I, king of Scotland, presented a considerable estate and an Arab horse, with valuable accouterments, to the Church of St. Andrews. What this horse did for the Church or people, the monks have not thought of enough importance to record. This was during the reign of Henry I.

First English Race-course.—During his reign the first race-course was established at Smithfield, which was used both

as a horse-market and race-course. Let us keep in mind that Henry I was the son of William I, surnamed Conqueror, and Matilda of Flanders, and that these kings held power in England and on the continent. It is plain that under such intimate relations of Flanders and England the blood of their horses was freely mingled, and the value of the Flanders horse became appreciated in England for war and agriculture. We have said the Spanish horse was esteemed by William at Hastings. Herbert doubts if the English then were aware that the value of their horses came from the large per cent of Oriental blood in their veins.

The Flanders Element.—King John, who gained possession of England and Normandy in 1199, “paid great attention to the improvement of horses for agricultural purposes, and he has the credit of originating the draught-horses of England. He imported at one time one hundred chosen stallions from Flanders. He was so anxious to possess the finest stock from them, that he accepted strong horses for rent of crown lands. One hundred years later, Edward II purchased thirty war-horses and twelve draught-horses from Flanders and Germany. Edward III had many running horses, and purchased fifty Spanish horses, at a cost of £160 each. Coming down to Henry VII, we find that he caused under-sized horses to be destroyed, and had great numbers of full-sized mares and stallions kept in the deer-parks and rural parishes. His reign was marked by an increase of powerful, well-formed animals, adding greatly to the wealth of his people. One authority states that at the close of a May party the king and his brother-in-law, the Duke of Suffolk, rode races on great coursers, like the Flemish breed of Arab horse. During the reign of Henry VII (1509–1547), an “annual race was run at Chester, the prize being a wooden ball, handsomely embellished, for which, in 1540, a silver bell, called St. George’s Bell, was substituted. Hence the phrase, “Bear the Bell.” “In the reign of James I races were merely matches against time, trials of speed and bottom, for long and ‘cruel distances.’” From this time, the history of English racing may be said to fairly begin.

The Pedigree of Race-horse.—The pedigrees of the race-horse do not clearly trace to the time of James I; but from his reign down to the present time there has been an increasing carefulness as to the matter of breeding horses for speed and endurance, as well as for intelligence and strength. From what has been gathered from the writers on the horse, and from extended research among history and literature incidentally detailing items of interest about the horse, we see that what is now known as the thorough-bred or race-horse had its origin in England prior to the seventeenth century, and that the Oriental horse, coming to England through Spain, Gaul, Italy, Arabia, Barbary, and Thessaly, together with the more ponderous animals of Normandy and Flanders, made the base on which the English breeders of horses have builded, and by an intelligent selection have, in the course of two centuries, produced a horse far superior to any that contributed to the make-up of the parent stock of the matchless thorough-bred.

The Historic Trio.—The breeders of the English thorough-bred of this country have special pride in tracing the ancestral lines of the best race-horses to three animals, of which history furnishes fairly intelligent and accurate accounts. First, the Byerly Turk, used by Captain Byerly in King William's war in Ireland; second, the Darley Arabian, imported from Aleppo, in the reign of Queen Anne (1700–1706); third, the Godolphin Arabian, of which we spoke under the history of Arabians. These horses, bred to English mares already infused with Oriental blood, produced horses of rare speed, endurance, and quality. The value of the Arabian blood became so esteemed that the proof of its presence became important.

The Stud-book.—In 1791 a Stud-book was established. The first volume appeared in 1808. It traced pedigrees back to the beginning of the eighteenth century. Of course it contained inaccuracies; but it is now accepted as the most reliable authority in matters of breeding of the race-horse or thorough-bred. From our history it is evident the term thorough-bred is a misnomer, as the breed of race-horses has, perhaps, as many elements in its make-up as has any breed of animals of which a

record now is made. The Arabian, the barb, the Turk, the Spanish, and the Gallic horse mingled with the blood of the ponderous Flanders, Norman, and English horses.

From such an ancestry came the breeds of England. But the forms the horse in the British isles has been made to assume under the laws of selection and variation, guided by the intelligence and good judgment of the English and Scotch breeders, fill us with admiration at the wonders nature and man may perform. By a judicious crossing and training and feeding, the same tight little isle has in two centuries evolved the wonder of the ages in the thorough-bred; and from and by the aid of his ancient ancestry come the hunters, hackneys, coach and cart horses, each of great excellence for their special uses.

Climatic Influence.—There is nothing in the climate to account for the rapid development of the horse in England. Darwin in his *Domestication of Plants and Animals* shows that a damp climate does not favor the development of the highest type of the horse. In climate the Arabian or barb had the advantage, and Darwin says that America favors a higher development of the species, because of its superior climate and excellence of forage. Mr. William Percivall, in 1834, at University College, said: "The grand first cause of this success appears to come from a steady prosecution and scientific management of breeding, by which I do not only mean the procurement of original stock of a good description, but the continual progressive cultivation of that stock in the progeny, by the greatest care in rearing and feeding, and by the most careful selection. On these two circumstances, and particularly on the latter, a great deal more depends than on the original characters or attributes of the parents. Thus we have progressed from good to better, losing sight of no subsidiary help until we have attained a perfection in horse-flesh unknown in the whole world beside."

Size and Power Sacrificed to Speed.—The fusion of bloods has added size and strength to the finely formed Oriental horse, and diminished none of his spirit and docility. The thorough-bred excels the best Arabian blood in size and speed and endurance.



THE FAMOUS OLD ENGLISH THOROUGHBRED "VOLTEGEUR."

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The thorough-bred was bred for running. In his early history endurance and power were of more importance than speed. It is to be regretted that, in the last half century, speed has been the great desideratum, and to secure it there has been a reduction in weight, the shoulders are lighter, the hips not so broad, and the muscles finer. As a means of improving other horses for the road and the farm, or for war, he has lost in proportion as his stoutness has diminished.

The farmer and the business man demand a horse that can make himself generally useful. "Without high breeding, however, this is impossible," says Stonehenge. He thinks the English should interfere and prevent the diminishing of size and quality of the thorough-bred in the mad effort to attain speed only. Youatt likewise deplotes the same evil. By careful selection and breeding for the most powerful and lasting horse, it is argued that England can furnish the model horse for business, pleasure, and the cavalry, by use of thorough-bred sires of stamina and substance. Stamina, or power to endure, comes with the best breeding, as is indicated by the old proverb, "An ounce of blood is worth a pound of bone." Stonehenge says: "But, in spite of all this recognized superiority of blood, it is indisputable that, for the highest degree of success, there must

be not only high purity of blood, and that of the most winning strains, but there must also be a frame of the most useful character if not always of the most elegant form."

Draft Horses.—We now come to a class of horses that should interest every farmer, teamster, and breeder of horses for profitable use or sale. In the history of thorough-breds we alluded to the Flanders horses,



HEAD OF FRENCH HORSE.

and those of Normandy, and showed that they were important factors in the improvement of even the ancient and power-

ful race-horse of England. If a complete history of the horse in the feudal ages could be found, it would doubtless show that the English as well as the French are indebted to the farmers of Flanders for the foundation crosses on which have been produced by selection, and infusion of the choice Oriental blood, the modern breeds of draft-horses, now so much esteemed.

The Flanders Element.—William the Conqueror imported many fine horses from Flanders and Normandy. His powerful cavalry gave him the victory at Hastings, but he showed his appreciation of Oriental blood, in that he rode a Spanish horse. Under his reign we find the first mention of the horse in agriculture. Henry I, the son of William the Conqueror and Matilda of Flanders, was influential in transporting the large horses of Normandy and Flanders across the Straits of Dover, for use in the studs and on the farms of England. King John took possession of England and Normandy about 1200, and took pride in the improvement of the horses of England for purposes of agriculture. He has the credit of originating the draft-horses of England and Scotland. He valued the Flanders horse so highly that history tells us he imported at one time one hundred stallions from Flanders.

The reign of Henry VII was marked by increase of powerful, well-formed horses. At a May-party, he and the Duke of Suffolk rode a race on "great coursers like the Flemish breed of dray-horses." By the time of Henry VIII the Flemish breed of draft-horses must have been well known in England, for immense size and massive proportions. He said of Princess Anne of Cleves when he first saw her, "Egad! she is built like unto a great Flanders mare." His coarse remark was appreciated by his courtiers as a fitting simile, and was received with shouts of laughter.

The low country in Western Europe, now included in Belgium, Holland, and France, stretching along the German Ocean from the west inlet of the Scheldt to the entrance of Straits of Dover, joining the province of Artois on the south, was first called Flanders in the seventh century. It took the name of

Normandy about the beginning of the tenth century, from the Northmen, who then got possession of it.

The Norman Name.—The first duke of Normandy and direct ancestor in the sixth generation, of William the Conqueror, “was so mighty of stature,” says Snorro Sturleson, “that there was no horse of strength and size to bear him. He was therefore always on foot, and was called ‘Rollo the Marcher.’” This was in the tenth century. He distributed among his followers the lands of Neustria, and laid the foundation of the feudal system, which later was transplanted to England. With this vigorous race of people came marked and rapid changes in the low country, where, even during the feudal ages, agriculture flourished, and the abundant crops produced along the fertile valleys in a genial climate soon gave size to the cattle and horses of that noted country. Because of the enterprise of these Northmen, now called Normans, we find the name became a synonym of power.

From euphony or association must come the precedence given the name Norman, to the horses of that country, rather than that of Flanders. The Flanders horse was the product of high agriculture. The climate, liberal feed, and diligent care, combined with the infusion of the blood of the best horses which a line of conquerors could gather from the nations they ravaged, laid the foundation for the noted breeds of powerful horses that have become most valuable in this age, when the sword is less trusted than the plowshare.

The Norman Conquests Mingle Bloods.—We may find a clue to the large infusion of good blood into the powerful horses of this noted country, in the conquests of the Normans. Rollo devastated Holland, and appeared as far south as the Seine. A band sacked Bordeaux, Lisbon, and Seville. They defeated the Moorish conquerors of Spain, crossed the straits into Morocco and back, overran Tuscany, and returned to France. They made safe winter-quarters in Spain, and from there ravaged Naples, Sicily, and the coasts of the Greek Empire. These very countries will be recognized as those especially rich at that time in horses of Oriental blood. The Moors had

the finest of cavalry, when they entered Spain. Their horses were of the breeding such as gave the barb power to impress the best blood of England with new life, courage, endurance, and fleetness. In 912 the most redoubtable of the Northmen, Hrolf, afterwards called Rollo, accepted the hand of a daughter of Charles the Simple, and the territory north of the Seine, from Audleys to the sea, known as modern Normandy, in exchange for Christian baptism and an oath of fealty, and from this date we find the energy of this wonderful people turned from conquest to the arts of peace. The rich country was made richer and more powerful by the infusion of the best blood of the horses of every nation that had made progression in civilization, which then was synonymous with the improvement of the horse for war and ceremony.

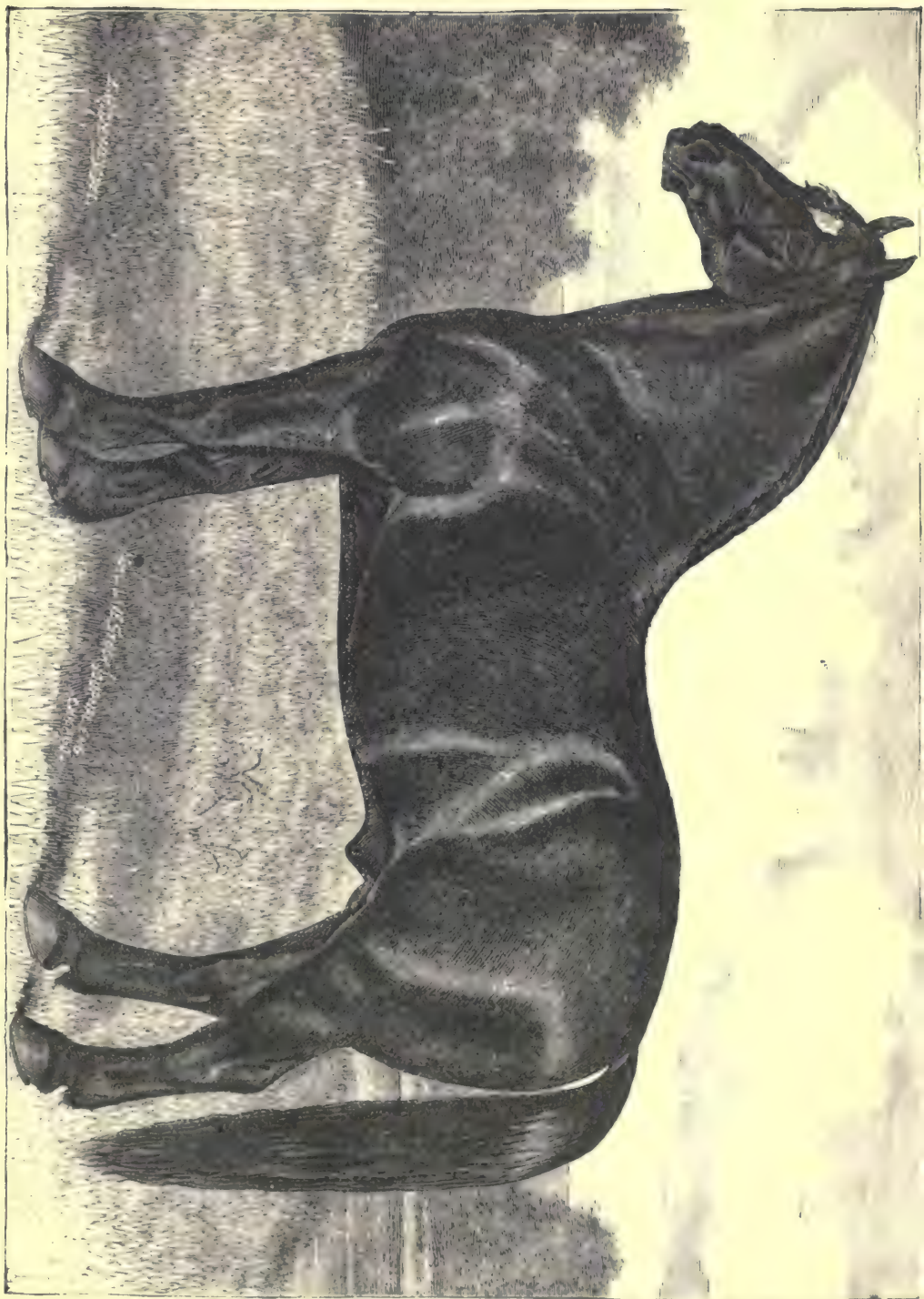
Soil and Climate Affect Size.—In the low country of East and West Flanders the country is generally flat, and along the Scheldt and its tributaries have been agricultural prosperity, and great numbers of horses and cattle produced. The climate, soil, and herbage, and diligent care, have combined to produce great growth among the horses of that region. It is there English and American buyers find the massive horses that are sought especially for size and powerful draft.

In the interior of France, where the country is more elevated and varied in surface, and the air rare and bracing, and the pastures closer and more concentrated, we find a smaller type of horse, with more activity and endurance. The history bearing on the development and foundation of the long-established breed of powerful horses will help us to understand something of the elements of blood, and the training and uses that have combined to establish a powerful type of horses, combining excellencies of form and temper, and action and power, such as to attract the attention and admiration of all nations and people who have advanced in civilization and the arts of husbandry far enough to make the horse a valuable factor in labor. From the foundation laid in that historic country we note an advance to make such improvements as the taste, habits, and necessities of a people demand.

This ancient history, thus briefly and imperfectly traced, may be fairly considered the early history of all noted draft-horses of the present century. France and England, located near this remarkable territory, where the Northmen settled and founded a mighty people and a mighty breed of horses, have not only been most affected in their language, habits, and history by contact and intercourse, but have also drawn from it horses which have enabled them to establish their best breeds of draft-horses, as well as horses of power and action and docility, suited to the work of the plow or wagon.

The French Draft-horse.—In the United States the farmer is bewildered by the number of names given to the draft-horses imported from France. He hears them called Normans, Percherons, Percheron-Normans, and Norman-Percherons. The advocates of the name Norman claim this name, because two centuries ago there was a noted breed of powerful horses in Normandy; but they have failed to show that this breed had any more to do in the make-up of the horses of the ancient province of La Perche, than had the powerful horses of Flanders, which became noted before those of the country south of it.

La Perche was an ancient division of France, in the old province of Maine, and is now divided among the departments of Orne, Eure-et-Loire, and Eure, and is not so insignificant a department as some would have us believe. But the powerful horses, which are the base of the modern Percheron, were not confined to Normandy, nor does history warrant the conclusion that they were superior to those of Flanders or Picardie, or of the country along the Scheldt, whence the modern breeders of draft-horses in England and France have drawn mares and stallions of great excellence. It is clear that the mighty race of horses was not confined to any one of the provinces named. As far back as the time of William the Conqueror we know they had, from the Scheldt south to Bretagne, a most powerful horse; large, active, and spirited, well suited for the mode of warfare when the riders wore heavy coats of mail, and carried heavy lance and battle-ax and sword. How these wonderful horses were produced has not been recorded in history. But



the country was well suited to raising horses, because of the fine climate, rich pastures, and abundant feed at all seasons of the year, so the foals never had check in growth.

The Demands of War Mould the Type.—The use of the horse in their mode of warfare led to the selection of the hardiest and most imposing in appearance. Great weight and powerful action were requisites in their onslaughts, when riders were unhorsed and horses hurled to the ground by the violence of their collisions. In such uses the horse of greatest weight and activity had the advantage. The feed, climate, and necessities of their uses developed a powerful race. But the high courage and docility and activity of these great horses point to a large infusion of Oriental blood. This came with the frequent incursions from the south, invited by the fertility and abundance which have characterized this eastern coast of France for centuries. The Saracens, three hundred thousand strong, as far back as 732 A. D., invaded this land, and left the finest blood of Arabia and Barbary on the plains, between Poitiers and Tours, in the possession of Charles Martel and his valiant followers. The crusaders brought another installment of the choicest blood of Arabia.

These were some of the means by which the noble race was made more noble within the time of well-authenticated history. From the same we may learn of frequent irregular supplies of fresh blood from Arabia and Andalusia. Then we come to the men of wealth and public spirit, like Lord Montdoubleau, Geoffroy IV, Rotrou, Count of Mallart, Count of La Perche, Count Roger, and many others of the nobility who interested themselves in the improvement of the horses of France. As late as 1820 we find the government of France fostering the breeding of horses and the historic gray stallions, Godolphin and Gallipoli, left their impress in the studs of the Empire.

The Evolution of the Percheron.—The country of La Perche was especially favorable in elements of soil and climate for producing horses. The people, too, were, and are, as fond of their favorites as ever were the Arabs in their best estate. The pride of the people was gratified by the fostering care of

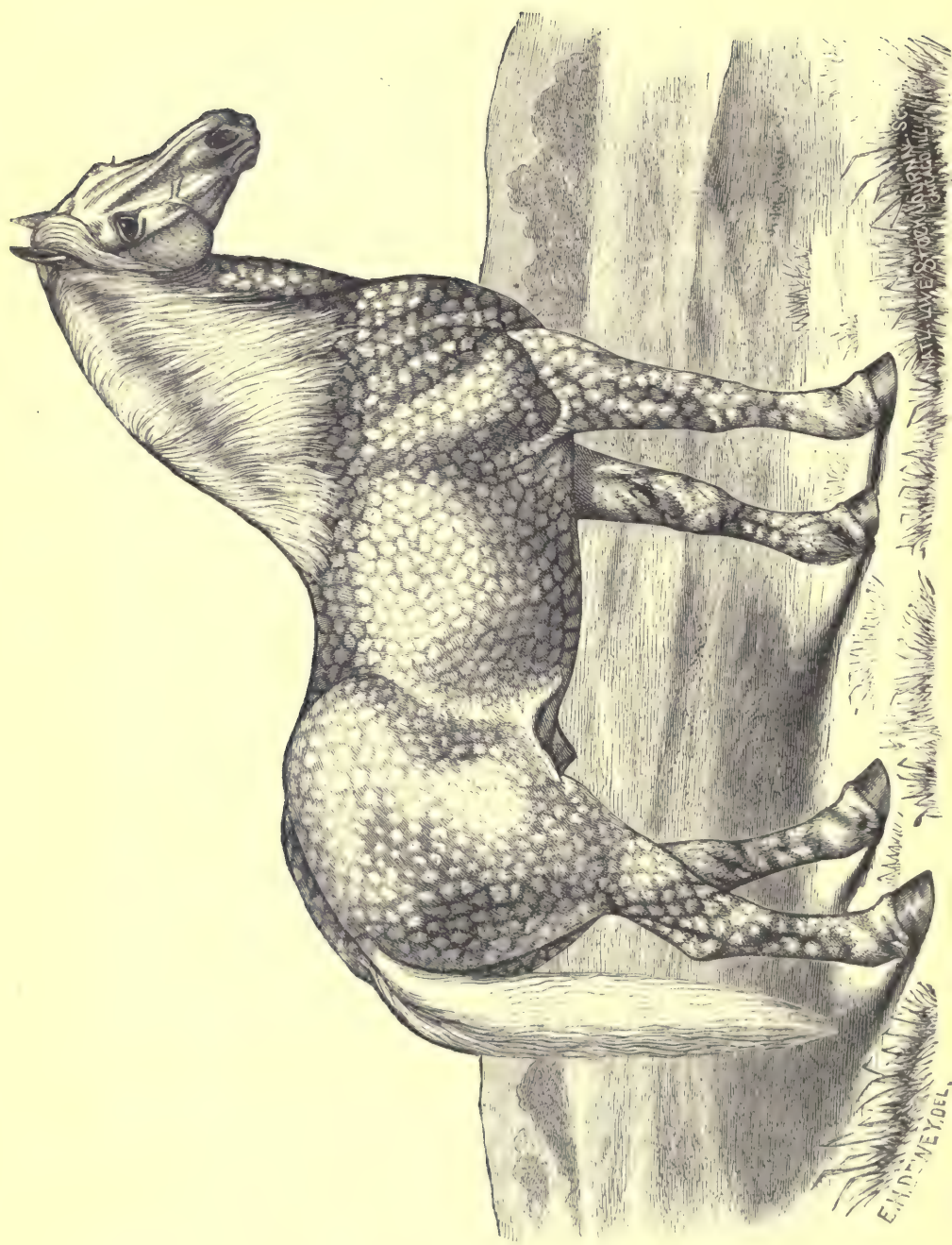
the government. Like the Arab, they left entire their horses that they might have the widest range of selection for crosses. Their uses in war made a demand for the horse of greatest power, hardiness, and spirit, for which centuries of like wants created a constant demand, which it was to the interest of farmer and ruler to supply. Such influences were more powerful and constant in the evolution of the Percheron horse than can be the fitful and limited aims of the most enthusiastic combinations of men of diverse interests and tastes. While we may search in vain for the starting-point in the history of the French draft-horse, at which there was a distinct breed formed by a known and recorded combination of blood, we are assured that a distinct type has been established on the law of selection and "survival of the fittest." We find in France a most wonderful race of horses, so allied to the Arab and the ponderous ancient breeds of Normandy and Flanders, as to concentrate in a better form the excellences of both.

Ohio Investigates the French Horse.—In 1865 the Ohio State Board of Agriculture sent their Secretary, Hon. J. H. Klippart, to France and the German States to study methods of agriculture and stock-raising. His report may be found in the Ohio Agricultural Report for 1865. He describes the various subdivisions of Percherons as follows :

"In the Percherons, various subdivisions may be distinguished : The 'FINE PERCHERON,' chiefly in the departments of Eure and Loire and Cher, is a powerful, fiery animal, very well fed from youth up, with oblique shoulders, long croup, and projecting hips ; very fine specimens are found on the Cantons d'Il-lers, Courville, and Chateauneuf, where they are fed as much oats as they can eat."

"THE 'HEAVY PERCHERON' on the Orne, Sarthe, and Eure, is nothing less than a fine or well-built animal, but a horse renowned for heavy draft."

"THE 'SMALL PERCHERON,' in the west, in the vicinity of l'Aigle and Mortague is much smaller and lighter, has straighter shoulders, a shorter croup, hips more level than fine ; yet he is a solid and useful horse, but not very fast." The "Small Per-



cherons" are found in large numbers in the omnibus stables, but a few only of the "Fine," because they are used by the administration. The latter are more frequently seen in the mail omnibus, conveying the letter-carriers to their respective districts, and in private wagons.

"The Percherons are mostly dapple-gray, and, while young, iron-gray."

So-called Percherons.—In 1873 Mr. Klippart, in a letter to a Chicago journal, wrote: "Since 1866 a great number of so-called Percherons have been imported into Ohio from France." He says he has not seen one of these so-called Percherons which possesses all the points, style, and action of the Percherons he saw in France. He expresses surprise "that some of our otherwise well-informed horsemen dispute the existence of a breed known as Percherons." He cites, after thorough examination of written history in Paris, and after close study of the horse and the methods of breeding and handling them, the best of authority found in authentic encyclopedias of agriculture to prove that so early as 1790 it was recognized there as a separate and distinct race or breed. "The origin of the breed is no less obscure than that of the Short-horn." Those desiring to further examine the history of the noted Percherons are referred to his report.

Corroborative of the views presented before, we quote from Vol. I, *Percheron-Norman Stud-book*, revised edition: "In that part of Normandy lying along the coast, especially north of the Seine River, the Flemish element seems to have made its influence more strongly felt, and there the horses possess more of the Flemish and less of the Percheron characteristics than those bred farther south, in the heart of La Perche, which will account for the diversity in the character of the horses brought to this country by our importers. Those who have purchased near the coast, or north of the river Seine, have usually obtained horses that leaned strongly toward the Flemish type. They are larger, coarser, and more sluggish, with less energy, endurance, and action than those bred in Eure et Loire and the adjacent departments. They are better adapted to heavy draft purposes than their lighter but more hardy, active, and stylish

relations of the interior, frequently weighing from seventeen hundred to two thousand pounds in high flesh, and producing larger horses when crossed on our common stock.

The Flemish Blood preponderating in the composition of the former, they and their progeny partake more of the draft-horse type, while south of the Seine and towards the interior may be found a type which possesses nearly all of the good qualities which have made the pure Percheron race so famous, modified by a reunion with its ancient kindred blood of Northern France, which has given it greater size and other qualities which justly entitle it to be called, *par excellence*, the *farmer's horse*."

The Name Norman in America. — This remarkable, many-named breed of horses is destined to have a wonderful effect on the horses of America, and a history would be most defective which does not notice the introduction of this blood to our country. The energy and enterprise of the Norman people led them, as early as the 16th century, to explore the St. Lawrence river, and to attempt to colonize its banks. They founded Quebec, and as at that time they possessed the best horses in all Europe, and were improving their lands at home, making it "one of the best cultivated and most industrious provinces in France," it is scarcely possible that they would not bring to their new colony some of their choice horses. We have, in the Canadas, a breed of horses which inherit marked characteristics of the French horses called Normans, modified by climate, feed, and uses peculiar to the more severe climate. The Pilots, the Royal Georges, the St. Lawrences, the Copperbottoms, and the Morgans, all show marked characteristics of the race as bred two centuries ago in La Perche, then a part of Normandy.

About the year 1816 a stallion came into Canada from France, called European or McNitt horse. He was sire of the Morse horse, and founder of the famous Norman family, of which Lula, May Queen, and the Blackwoods have been especially noted. "This horse is described as a large, dapple gray; nearly white, about sixteen hands high; clean flat legs, beautiful head, body long and round, back short, loins strong, lofty carriage, strong, active, and a very fast trotter. Mr. James McNitt, of

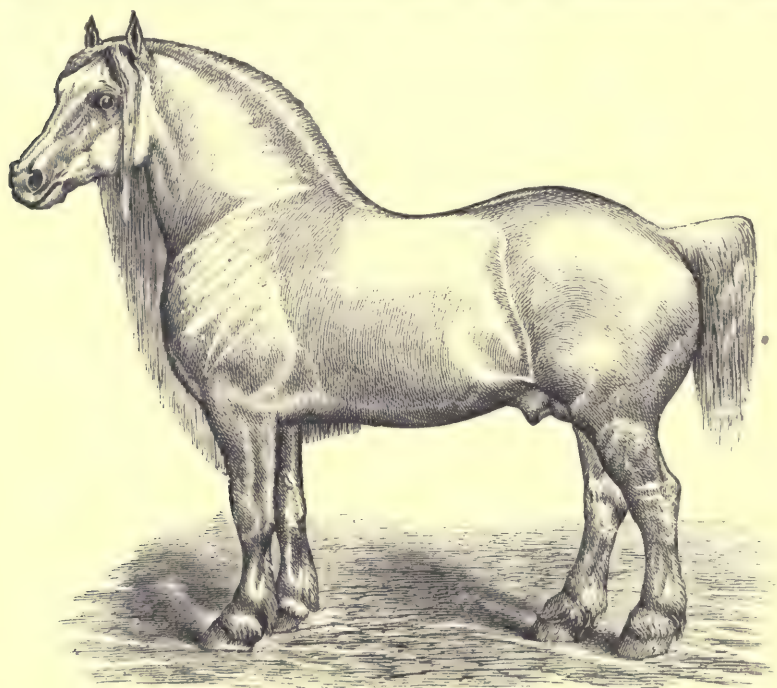
New York, bought him near Montreal, about 1826 or 1827, and the stallion became better known through his own son, the Morse horse, sire of Alexander's Norman. The McNitt horse was known as an imported horse, and in every particular of color, size, form, action, and character, he may be considered a true representative of the race, as bred at that date.

The French Blood in Canada and New Jersey.—In 1839 Mr. Edward Harris, of Moorestown, New Jersey, purchased two stallions and two mares of French blood, but landed only one, that a mare, safely on his farm at Moorestown, New Jersey. In three weeks time he returned to France, and was more fortunate, bringing back the stallion Diligence, and two mares. In writing to a friend about these horses, he says: "Those who are acquainted with the thorough-bred Canadian horse will see in him a perfect model, on a small scale, of the Percheron horse." This is a peculiar breed of Normandy, and, from the best French authorities, he claims they were produced by the cross of the Andalusian horse on the heavy Norman horse. This horse Diligence was heavy, compactly built, and a little over fifteen hands high. He is said to have made a valuable impress on the stock of New Jersey and Eastern Pennsylvania.

French Horse in Ohio.—In 1851 Messrs. Charles Fullington and Erastus Martin, of Union County, Ohio, went to France, in quest of fine cattle and sheep, for the Darby Plains Importing Co. Mr. Fullington, like Mr. Harris, became impressed with the superiority of the French horses, when riding behind them over hills and valleys in the heavy diligences of that country. It is told that Mr. Fullington was led to select and buy the big, gray, three-year colt through the persuasive powers of his landlady, Madame Bailleau. The colt proved the lady to be a good judge of a horse; for that short-legged, blocky, close-ribbed colt was none other than the famous *Louis Napoleon*.

"The French horse," as he was called by Mr. Fullington's neighbors, was not appreciated until his foals began to develop. In the autumn of 1854 Mr. A. P. Cushman, of DeWitt County, Illinois, purchased him for \$1,500. and he kept him until 1858,

selling him to Messrs. Dillon, who kept him until his death, in 1871. He got glory for himself, and shekels for his owners and the State of Illinois. "He was undoubtedly the best known and most popular French horse ever brought to America," says the author of the *Percheron-Norman Stud-book*. It is estimated that he left over 400 successful sires among his sons. In 1851,

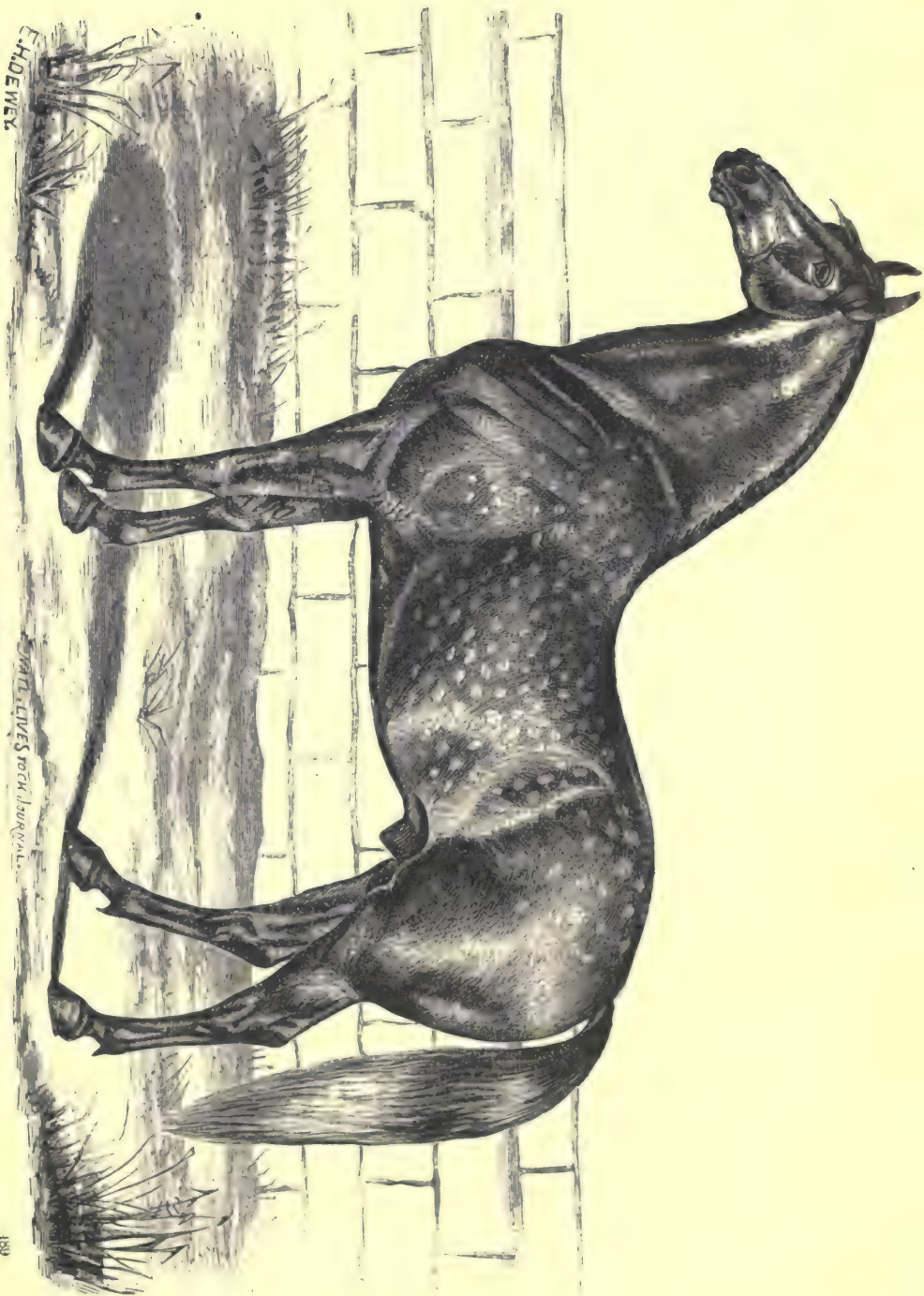


OLD LOUIS NAPOLEON. 281.

First French Draft-horse imported to the West. Imported by Fullington & Martin, of Union Co., Ohio, in 1851. Died Aug. 13, 1871, aged 23 years, the property of Dillon Bros., Normal, Ills.

Dr. Marcus Brown, of Circleville, Ohio, imported Normandy, or the Valley horse. He was kept at Circleville until 1856, when he was taken to Pleasant Valley, Madison County, Ohio, where he died in 1872.

The French Horse in Illinois.—In 1868, W. J. Edwards, of Illinois, imported Success and French Emperor. Success has, since 1874, been at the head of Mr. M. W. Dunham's stud, and French Emperor was sold to Hon. J. B. Grinnell, of Iowa. These horses and their get, have established the character of the French horse in America.



HAIR-BLOOD PERCHERON STALLION. Sire, Napoleon II. Dam, choice native mare. Bred by M. W. Dunham, Wayne, Ills.

NAPOLEON III.

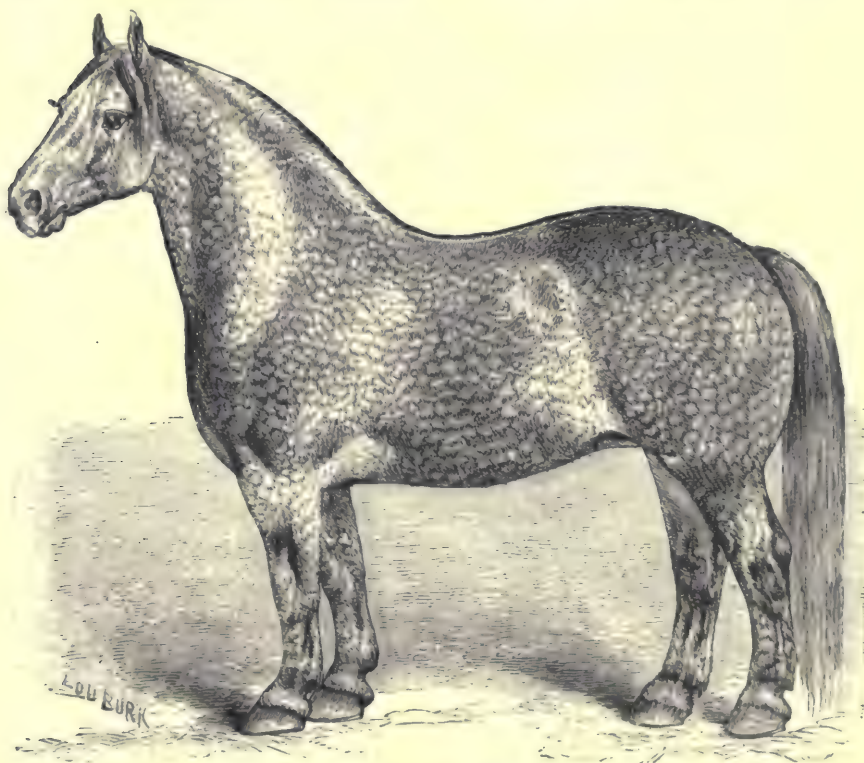
CHIDNEY'S ROCK JOURNAL.

By the politeness of Mr. A. J. Sanders, author of the *Percheron Stud-book*, we are able to present the

Model for Percheron Horse.—"Head clean, bony, and small for size of animal; ears short, mobile, erect, and fine pointed; eyes bright, clear, large, and prominent; forehead broad; nostrils large, open, and red within; jaws rather wide; chin fine; lips thin; teeth sound and even. Neck a trifle short, yet harmoniously rounding to the body; throttle clean; crest rigid, rather high and gracefully curved; mane abundant with silky hair. Breast broad and deep, with great muscular development; shoulders smooth, and sufficiently sloping for the collar to sit snug to them; withers high; back short and strongly coupled; body well ribbed up, round, full, and straight on the belly, which is much longer than the back; rump broad, long and moderately sloping to the tail, which is attached high; hips round and smooth at top, and flat on the sides; quarters wide, well let down, and swelling with powerful muscles. Dock strong; tail long, heavy, and gracefully hanging out from the croup, when the animal is in full motion. Legs flat and wide, standing square and firm, and well under the body; with hard, clean bones, and extra large, strong joints, cords, and tendons; short from the knees and hocks down; pasterns upright; fetlocks thin; hoofs full size, solid, open, tough, and well set up at the heels. Height, fifteen to sixteen and one half hands; weight 1,300 to 1,700 pounds. Color various as with other horses, but a clear, dapple gray is preferred, as the best of the original breed were thus marked. Action bold, square, free, and easy; neither fore-reaching nor interfering; the walk, four or five miles per hour; the trot, six to eight, on a dry and moderately level road, but capable of being pushed much faster on the latter gait when required. Temper, kind; disposition, docile, but energetic and vigorous; hardy, enduring, and long-lived; precocious, able to be put to light work at 18 to 24 months old; possessing immense power for his size; never balking or refusing to draw at a dead pull; stylish, elegant, and attractive in appearance; easy, elastic, and graceful in motion. No tendency to disease of any sort, and especially free from diseases of the

legs and feet, such as spavin, splint, ring-bone, grease, and founder. An easy keeper and quick feeder.

Model for Mare.—With rather less size than the horse, the points and qualities of the mare should be essentially the same, with the exception of possessing a finer head, mane, and tail, and a considerably thinner neck; when in foal, able to work



MODESTY, 998.

FULL BLOOD NORMAN MARE. Sire St. Laurent, 753; dam imported Gertrude, 943. Bred and now owned by Dillon Bros., Normal, Illinois. First premium and sweepstakes at Illinois State Fair in 1881 and sweepstakes in 1883.

moderately to within a few days of giving birth to it, and, a short time after, able to resume her work; a careful nurse and good milker.

The points of excellence of the Normans are so similar to those given above that we submit this description as covering the leading characteristics of the French horses, whether called Percheron or Norman.

DOUBLE TEAM OF NORMANS.
Owned by J. C. Morrison, of Pontiac, Illinois.

"No. 10"

"No. 25"



The French Horses in Motion.—Instances are on record of performances of the diligence horses in France that show wonderful powers of endurance and great speed, when the vehicles and loads carried are considered. A French horse of the class "Small Percheron" made, in four hours and two minutes, fifty-eight miles, and came back over the same road the next day in a half minute less time, without urging. Another was driven fifty-five and three-fifth miles over a hilly and difficult road in four hours and twenty-four minutes, without distress. It is difficult to draw the line between the larger and lesser types; but the large horse, of great power, good action, and fine style will always be in demand, call him by what name we may.

The Norman Horse.—The hot rivalry between importers of the French draft-horses has led to confusion of names. Those who have sought the larger type of French horses have preferred the name Norman. That name is historic when attached to the grand old Northmen, who overran Europe and the British Isles, and affixed the name Normandy to a province of France. After the days of Rollo the Walker, the Normans seem to have turned their attention to the arts of husbandry, in which they excelled, as they had in the pursuit of war. The climate and soil, and care or management of horses, favored the growth of large horses in the coast regions of Normandy, as in Flanders and the fens of England and Scotland. But the horses of such lands, while larger, were more sluggish than the horses of the inland and more elevated portions, which have furnished a hardy, active, and spirited style of horses.

The history that attaches to the conquests of the old Normans has given a charm to the Norman war-horse, and distance has lent enchantment, and made the name Norman attractive and expressive of power and victory.

The first French horses that made their impress on the horses of Canada were named Norman, rather than French horses. After the overthrow of the French in Canada, it was good policy and natural for the conquerors not to attach the

name *French* to any thing left by them in the Canadas. The Norman name was sufficiently expressive and indefinite to attach to the noble specimens of horses the French left behind them. The impress made on the Canadian horse was felt on the New England horses; the Morgans, and the St. Lawrence family, and the Morse, McNitt, and Blackwood families, all trace to the French horses of Canada, known as Norman. But those horses were not of the ponderous, massive order that claim that name to-day.

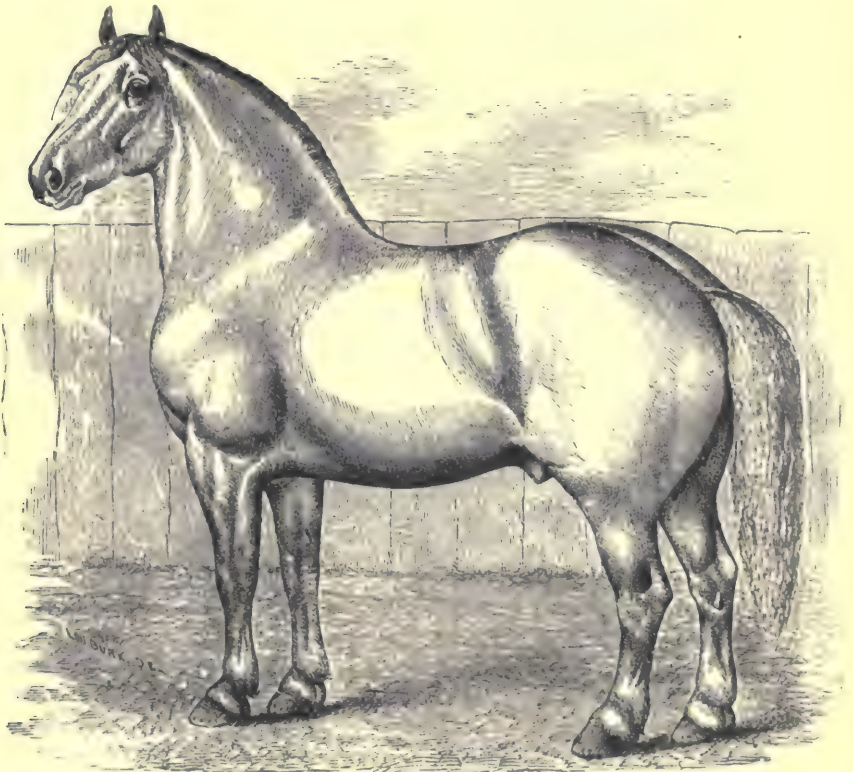
There is no good and sufficient reason why the French draft-horses, that came to America through Canada and the United States, should have two names, Percheron and Norman. But the war of names now is on, and no man can safely say when it may end. It is worthy of note, however, that the Percheron association and Norman association held conventions the same night, the former at the Grand Pacific and the latter at the Sherman House, in Chicago, November 14, 1883. They both passed resolutions of delight at the establishment of a record in France, and resolved not to admit to record here any imported horse that is not on record in the French Record.

The Norman is the name first used in America. The Percheron is the name used in France. Now as the *Société Hip-pique Percheronne* of France is to be the arbiter of the breeding of animals that are hereafter to be imported into America the name FRENCH DRAFT-HORSE seems fitting and correct. The description and history given the French draft-horse covers the French importations sufficiently, and we may see that the war of names has more significance and interest to the parties who have espoused them than to the public generally.

We have spoken of the famous Louis Napoleon, which was the first French draft-horse brought west of the mountains, and the horse whose get brought the race into notice in the West.

We will speak of another famous horse, St. Laurent, imported by Messrs. Dillon in 1870. He is a Norman horse of rare excellence, and his colts readily bring \$1,000 to \$2,000. His owners have sold mares and stallions sired by him to the amount of \$27,000. His services up to January, 1882, brought \$23,060.

The value of his get still on hand November, 1882, \$44,000; making a total from the horse, between 1870 and 1882, of \$94,060. But as others have sold in McLean County many of his colts, it is claimed that St. Laurent has been worth to his owners and the farmers of McLean County, Ills., the fabulous sum of \$200,000.



ST. LAURENT, 753.

NORMAN STALLION. "Largest, heaviest-boned, and most powerful horse ever imported;" weight, 2,100 pounds. Imported and owned by Dillon Bros., Normal, Ills.

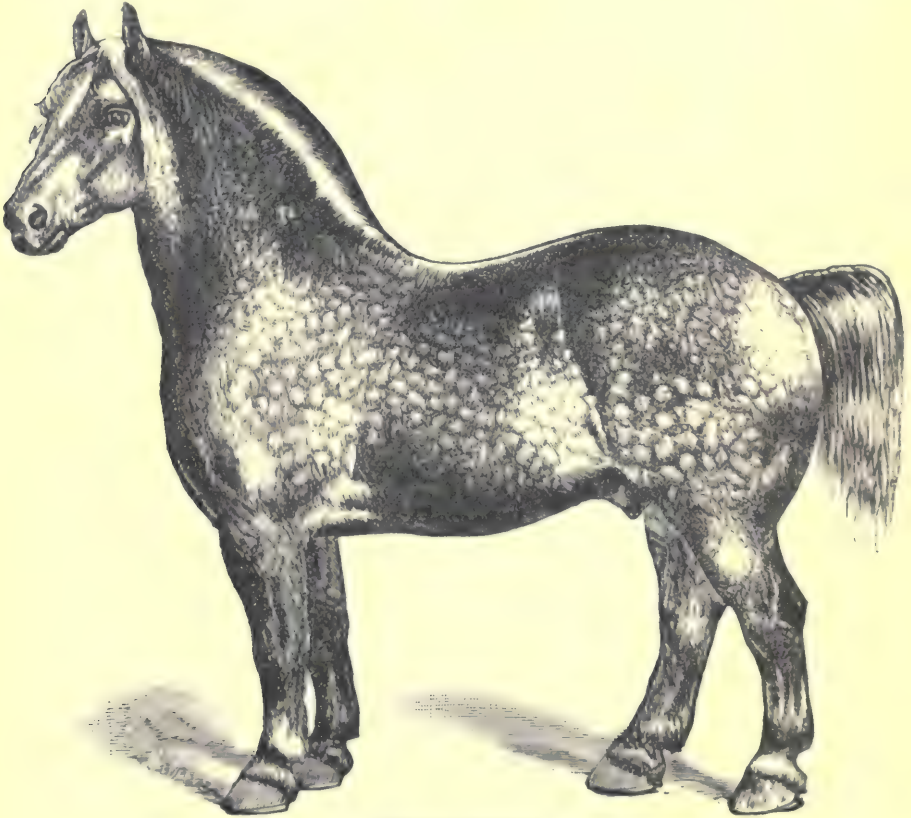
The Canadian Horse.—Some one has said the Canadian horse was but the French draft-horse in miniature. Herbert says, "The Canadian horse is originally, beyond doubt, the French Norman horse." His type is not obliterated by a cross of thorough-bred or hunter. His characteristics are, head rather large, but lean and bony, and well-formed; forehead, broad; ears, far apart, carried well up; eye, small and clear; aspect, bold and

courageous; crest, thick; chest, full and broad; shoulder, strong and a little apt to be too straight, as well as low and heavy at the withers; the barrel is stout, somewhat flatsided and not unfrequently too long; loins, excellent; croup, round and fleshy; thighs, muscular, and, "above all, the soundest, most undeniable, flat-boned legs that are to be found in any race not thorough-bred, and the toughest, hardest, and most iron-like feet that are to be found in any race whatsoever." They are singularly exempt from all ordinary diseases of the foot. The prevailing color is black, and the next is a rich, dark brown, often dappled on the shoulders and quarters. Some chestnuts, with legs and tails lighter than the body, are seen; and next occur dark iron-grays, with black legs. The tail and mane are very heavy, and the hair fine and wavy. The fetlocks up to the knee are covered with long, shaggy coat. They are compactly built, and range from fourteen to fifteen hands in height. They are not fast, but are hardy and have wonderful endurance. Whether the load be light or heavy, they bear it rapidly. They can make the eight miles per hour and keep it up. Herbert says not a few can be found which will accomplish sixty, seventy, eighty, and even ninety miles in one day.

The points of excellence which seem to be common to the Canadian and French horses leads to the inquiry, How comes it to be so? The question can not be answered in exact terms, but there are some historical facts that would help to an understanding of how the French blood made its impress on the Canadian horses.

Their Origin.—It is known that a colony from Normandy settled along the banks of the St. Lawrence in the sixteenth century, and they founded Quebec in 1608. Now, let us remember that the Normans had then become in Normandy as celebrated in the arts of agriculture as they had been famous in war. They were ingenious and enterprising, and Normandy was the best cultivated part of France. As early as the eleventh century adventurous knights from Normandy subdued Southern Italy by the power of their fine cavalry, and the successes of Norman princes for centuries depended largely on their

powerful cavalry. It was their pride, and in their efforts at conquest and colony it can not be supposed they would neglect to carry with them horses enough for defense and agriculture. The similarity of type of the Norman and Canadian teaches as surely a common origin as if the historians of Canada had given us a well kept record of crosses made and new blood infused.



CROWN JEWEL.

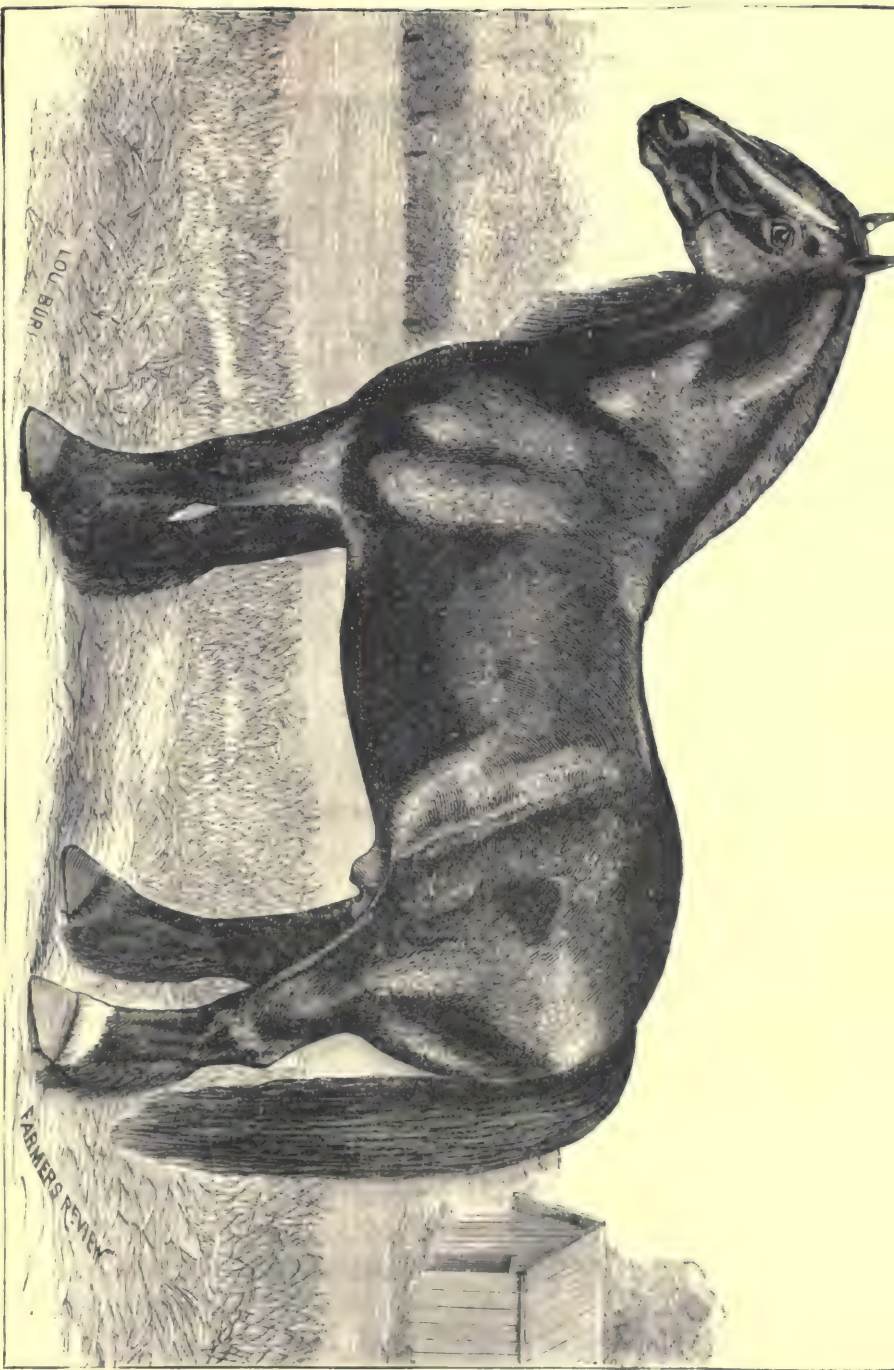
NORMAN STALLION. Imported and owned by Dillon Bros, Normal, Ills

Climate and Environment.—But how comes the decreased size of the Canadian? The cold and long winters, and the hardships endured by the neglected animals of a people of little intelligence or enterprise, would decrease the size of all their domestic animals. Climate, and environment, give character to all the animals. The fens of England and Scotland and Flan-

ders favor the growth of large horses. The bleak and barren Shetland Isles give us the diminutive pony of that region. The climate, feed, and neglect have made the Canadian horse a diminutive Norman, and though two centuries of neglect and scanty fare have reduced the size, yet the stamina and hardiness remain. A half century of selection of largest and best, and breeding only such, and giving abundance of suitable feed and exercise, will restore the plucky little Canadian to the size of his Norman ancestors.

As a base on which to build for improvement, Herbert says: "By breeding the Canadian mare, or, still better, improved progeny, to well selected thorough-bred horses, a very good roadster and highly improved light carriage-horse will be the result, and by breeding the female offspring of this cross again to the thorough-bred of sufficient bone and size, we do not doubt that the finest saddle-horses, phaeton horses, or light carriage-horses in the world can be produced, nearly of the same style as the Morgans, but superior to what the Morgans ever were in their best day."

The English Draft-Horse.—The horses known by this name in this country are known in England as cart or shire horses. The term shire horse applies to all heavy horses of England except those of Suffolk County. These are esteemed as a special breed, and are called the SUFFOLK PUNCH. Their origin is unknown. Some breeders claim them to be descended from the Norman or Flanders race. They are sometimes in England called the "Agricultural Horse." It is the draft-horse of the Midland Counties. An elaborate table in Vol. I, of the *English Cart-horse Stud-book*, shows something of the care long taken in his breeding. The first horse of note was the "Packington Horse," named from the town in which he was owned. He was in his prime about 1755. He traveled a number of years and begot hundreds of valuable colts. The true Suffolk, like the true Cleveland, is nearly extinct. But their virtues in comparison with successors in their former places have called for an effort to save them from becoming extinct from want of care in breeding. In England horses are bred, not only to meet the



ATLAS, 2,308.
ENGLISH SHIRE HORSE. Property of Wm. A. Macy, Lewisville, Ind. Sire, Ajax, 75; dam, Gipsy, sired by Major, 1,456.

wants of different lines of use, but shires and counties have peculiar points to breed for.

There is a wide range thus in weight, height, and style of English drafts, but they all are noted for great strength, hardiness, courage, and endurance. The heaviest of the cart-horses are bred in Lincolnshire and Cambridgeshire. They range from eighteen hundred to two thousand pounds, have very heavy bone, and abundance of hair on the legs from knee down. This is called "the feather." In America we find them spoken of as horses "with bangs."

In the Midland counties the horses are generally smaller, but of same general style. In Lancashire and Yorkshire the weight runs from sixteen hundred to eighteen hundred, with compact form, heavy bone, full sinews, and less feather. They are noted as rapid walkers, and some of the lighter can travel six to eight miles per hour with ease. This class of English drafts cross admirably on American mares, and give us active, strong horses, well suited for farm or general purpose work.

Effect of Soil and Climate.—"The fens of Lincolnshire produce the heavy drafts in the highest perfection," says Youatt. Though its soil is not better than other counties, there is something in the herbage, water, or soil, that favors great growth. It is another illustration of type of animals arising from peculiar natural conditions. Size of animals seems greatest in the fens of England or Scotland, or Flanders or Normandy, and in such soils we find the powerful growth and ponderous draft-horses. Elephants and hippopotami are never found in high uplands or desert regions, nor do we in such regions expect to find the massive ox or more powerful draft-horse.

Heavy Black Horse.—Before closing this topic we should speak of the famous heavy black horse, which is "bred chiefly in the midland counties, from Lincolnshire to Staffordshire." Youatt says: "These horses are adapted more for parade and show, and to gratify the desire which one brewer has to outvie his neighbor than for any peculiar utility. They are certainly noble-looking animals, with their round, fat car-

casses and their sleek coats, and the evident pride which they take in themselves, but they eat a great deal of hay and corn, and at hard, long-continued work, they would be completely beaten by a team of active, muscular horses, an inch and a half lower." The same might truly be said of all the enormous draft-horses which American farmers are just now getting on a craze for.

Points of English Dray-horse.—These ponderous black horses, or English dray or brewer's horse as often called, have a symmetrical form; head short and heavy, eyes mild-looking and small, ears broad, thick and short, neck strong and arched, breast broad and thick, shoulders upright and heavy, barrel round and deep, loins broad and high, quarters ample, forearms and thighs thick, legs short, hoofs round and broad at the heels, soles not too flat. By crossing with the Flanders horse of late, Youatt says the forehand has been raised, the legs have been flattened and deepened, and very much has been gained in activity. The heavy black, with his gait of two and a half miles per hour, has been lightened, and can step off four miles in the same time and endure longer.

The Scotch Draft-horse.—The Clydesdale is the pride of the Scotch farmer. Bonnie Scotland has found in the type of powerful horses bred on the Clyde her ideal of a useful horse.

The Clydesdale owes its origin, says Youatt, to one of the dukes of Hamilton, who crossed some of the best Lanark mares with stallions from Flanders. The Clyde is larger than the Suffolk Punch, or English horses generally, has a better head, longer neck, lighter carcass, deeper legs. He is strong, hardy, true, and rarely restive. They are sold from the valley of the Clyde, for coach, draft, and farm uses into even southern counties of England, and recently the importation of them to Canada and the United States has become large and is rapidly increasing. They are the "rapid draft" horses of the British Isles. "The long stride," says Low, "characteristic of this breed, is partly the result of conformation, and partly of habit and training; but however produced, it adds greatly to the usefulness of the horse, both on the road and in the fields, no



such loads are known to be drawn at the same pace by any horses in the kingdom as the single-horse carts of carriers and others in West of Scotland." "Though inferior in weight to the largest English, they possess properties which render them exceedingly valuable for ordinary uses. On the road they perform feats that can scarcely be surpassed, and in the fields they are found steady, docile and safe."

There seems to be a difference of opinion among American importers as to the origin of the Clydes, but, so far as known, the difference is slight, and may serve as a means of sharpening the edge of the advertiser rather than adding to the value of the horse or evolving the truth of history.

Be the origin detailed as it may, the student of the history and origin of breeds will conclude that the system of selection and variation has evolved the thorough-bred and the hunter. The thorough-bred is chiefly of Eastern origin, with the barb and Arab as his base. The English and Scotch drafts have their origin chiefly in the Flemish blood, and their individuality or types have been established on a line of different selections, and under the varying influences of soil, feed, climate, and handling.

The claims of importers of the English Drafts, that the Clydes have been built up on the English draft base, are amusing to one who has read the history of these breeds by men who had no ax to grind. Mr. Dysart, in letters to *Live Stock Journal*, says: "The English breeders told him that the Scotch breeders of Clydes had come over and bought mares of the cart-horse, to improve the Clydes; while the Scotchman claims the opposite to be the case." He says the English seem to have bred solely for size and strength, without action. While the far-seeing Scotchman had in view size and strength, combined with quick motion, and they have succeeded well in obtaining it in their horses. This accords with what Mr. Low says in his work. "Dealers from almost every part of the United Kingdom attend the markets of Glasgow and Rutherglen." "Many Clydesdales find their way to the central and even southern counties of England." "They are longer in the body than the

English black horse, and less weighty; compact and muscular, but they step out more freely, and have a more useful action for ordinary labor." "They draw steadily, and are usually free from vice."

Now, as Mr. Low's work is accepted as highest authority in description of domestic animals of the British Isles, his statements are worthy of credence in this matter, rather than the reckless assertions of dealers, who have assumed to instruct the public, while advertising their stock. The statements of zealous traders can safely be taken with discrimination.

The fact is, the Scotchman and Englishman alike got the size from Flanders stock. The Scotchman has, in his breeding, developed speed or free motion, while the English breeders seem to have lost sight of that, and have produced draft animals, marvelous for strength and size, and slowness of motion.

Boulonnaise and Conestoga.—Before leaving the draft-horses we should notice two other breeds, the BOULONNAISE and CONESTOGA. The latter was, in the last generation, quite extensively bred in Pennsylvania, but since the days of better roads, better vehicles and railways, his occupation of moving ponderous loads on to market is gone, and a more active class of horses have superseded it. The German emigrants of Pennsylvania gave the Conestoga preference. The breed was descended from early importations from Flanders and Denmark, and crosses on the stock found in the state. He was a heavy roadster and a fair draft-horse. Some of the best specimens were used for coach horses. As a class, they were rather leggy and too long in the back. They are rarely met now. The Clydes and Percherons have superseded them.

The BOULONNAISE is the name given to a large type of horse, weighing sixteen hundred to eighteen hundred pounds, more clumsy than useful. The American demand for large, French draft-horses has led some buyers to pick some of the best of this stock from Boulogne and about Paris for the American market. They are mostly gray, but bays and blacks are not uncommon. For heavy, slow draft they are said to be well adapted.



PRINCE GEORGE OF WALES AND MUSIC.

Cleveland Bays take the name from the uniform bay color of this most useful breed of horses, and the fertile district, Cleveland, County of York, England. Of them Prof. Low, in his most valuable history of domestic animals of British Isles, writes: "It is the progressive mixture of the blood of horses of higher breeding with those of the common race, that has produced the variety of coach-horse usually termed the Cleveland Bay. About the middle of the last century this district became known for the breeding of a superior class of powerful horses, which with the gradual disuse of the heavy old coach-horse became in request for coaches, chariots, and similar carriages. The breed, however, is not confined to Cleveland, but is cultivated through all the great breeding districts of this part of England. It has been formed by the progressive mixture of the blood of the race-horse with the original breeds of the country. To rear this class of horses, the same principles of breeding should be applied as to rearing the race-horse himself. A class of mares as well as stallions should also be used having the properties sought for. The district of Cleveland owes its superiority of this beautiful race of horses to the possession of a definite breed, formed not by accidental mixture, but by continued cultivation.

"Although the Cleveland Bay appears to unite the blood of the finer with that of the larger horses of the country, to combine action with strength, yet many have sought a farther infusion of blood nearer to the race-horse. They are accordingly crossed by hunters or thoroughbred horses, and thus another variety of coach-horse is produced, of lighter form and higher breeding; and many of the superior Cleveland curriele four-in-hand horses are now nearly thorough-bred."

Youatt says: "The Cleveland horses have been known to carry more than seven hundred pounds sixty miles in a day, and to perform this journey four times a week." In the latter part of last century, the Cleveland district, on the banks of the Tees, became noted for its heavy horses, suitable for coach and cavalry. The heavy, lumbering coaches of those days, as well as the poor roads, made a powerful horse a necessity to handle the heavy vehicle. He needed to be as strong as our omnibus

horse. Modern improvements in roads and vehicles have allowed lighter horses to be bred, and the change, too, called for more speed, which has been obtained by selection and crossing on choice mares, three-fourths or thorough-bred horses of sufficient substance and height. The bay color has been fixed as definitely as the red in the Devon cattle.



BUCKINGHAM.

CLEVELAND BAY STALLION, at 3 years. Height, 16½ hands: weight, 1,350 pounds.
Imported by Geo. E. Brown & Co., Aurora, Ills.

They come more nearly to the ideal of a general purpose horse than any other of the English breeds. They might be classed as *coach*, *carriage*, *draft*, or *farmer's horse*, according as specimens of the breed should be shown. One modern writer describes the Cleveland Bay as a large, elegant horse, standing

sixteen and one quarter to sixteen and three quarters hands, and weighing from 1,350 to 1,500 pounds; a fine head, full, bright eye, long, arched neck, oblique shoulders, deep chest, short back, long quarters, strong, cordy legs, and perfect feet. Their color, bay, full flowing mane and tail, and black legs, usually clear of white." They have been long popular in Europe as coach-horses, and have been sought for beyond the ability of the native region to supply, which fact has largely injured the reputation of the stock, as it has led to sale and use of horses not so well bred, and wanting the well-established and distinctive traits of excellence peculiar to this noble breed. When well-bred mares of this breed are crossed with large and powerful thorough-breds of bay color, the produce is nothing inferior to the old Cleveland Bay. Americans have turned their attention to this breed, and a few excellent specimens have been imported, and the crossing of them on our well-formed, large trotting-mares is giving a class of horses with style, action, and size to command the best prices. The market for such horses will not be overdone, since they are not only handsome but most useful.

The Farmer's Horse.—We have not yet in America a horse that meets all the wants of the well-to-do farmer. In the Middle and Eastern States, where good roads abound, and the farms are not so large, the horses which meet the views of the farmer are not large enough for those of the Western States, where gravel and good roads are scarce. There the heavy, powerful draft-horses are finding a ready sale, and are imported to cross on the mares of lighter caliber. The horse of docile temper and hardy constitution, with open gait and free spirit, prompt and reliable, never impatient under difficulty, ready to pull a light or heavy load, on good or bad roads, and able to walk a mile in six or eight minutes, or trot in three or four, and go to market twenty miles and back in a half day, and to stand heat or cold, soft roads, or hard, and not go lame, is yet to be bred for the American farmer. He must be more docile than the American trotter, more patient, and yet as spirited, and free of gait. He must have the docility and power of the Percheron, but greater

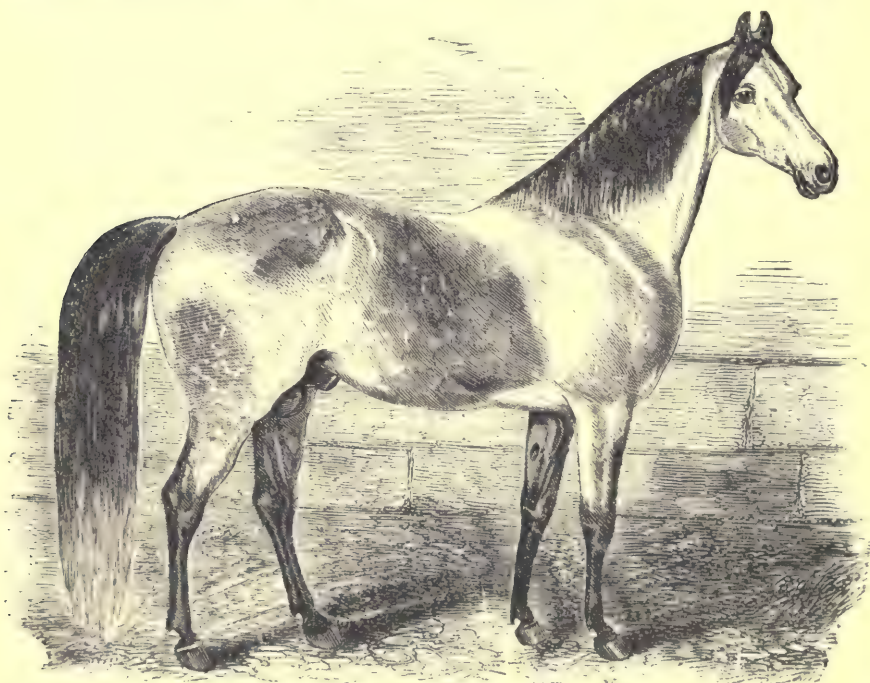
activity; he must have the pluck and endurance, the bone and hoof of the Canadian or the mule, and yet have more size and tractability.

The farmer's horse must be handy, hardy, prompt, docile, and true as steel. His size must be from fifteen and three-quarters to sixteen and one-quarter hands, and weight from eleven hundred to fifteen hundred pounds. He is neither a race-horse, saddle-horse, nor cart-horse. A level-headed, compactly made trotter comes nearer his ideal than any yet developed. The farmer's horse is yet in the future. The horses found with action, spirit, and pluck enough to suit him on the road to church, or to the village are not usually docile and patient enough at the plow, or in the mud with a heavy load. Occasionally a strain of horses has occurred in the history of breeding which has given ideal horses, but there has not been found the breeder with intelligence and wealth to persist in breeding on that line to establish a well-defined type. The farmer's horse of to-day is a conglomerate of no well-defined characteristics; so illy bred, and having so many scrub crosses, that no one can predict what the foal may be from the best bred sire. So uncertain is the first cross of a well bred horse on these nondescript mares that many farmers, nay the majority, claim that it does not pay to breed to a well bred horse. Until the principles of breeding are far better understood by horse owners generally, we may not hope to soon realize our ideal of the farmer's horse.

The Saddle Horse.—The day was in Kentucky, Virginia, and Ohio when every farmer owned a horse that would carry the rider with ease, on a walk of four to five miles per hour, and rack or pace eight to ten miles an hour the livelong day. The advent of good roads and light vehicles has supplanted this most useful and economical animal on the farm. In his stead has come the half-bred trotting-horse that can not walk a mile in ten minutes, or trot in five; instead of the saddle and bridle, come the buggy and harness, costing double that of the kindly and ever ready saddle-horse of the last generation.

We are glad to note the fact that a demand for good saddle-horses is again springing up, and that the people are recognizing

the fact that we have lost that best of all useful gaits, the *rapid walk*. The saddle-horse has a better disposition than the modern buggy and road horse. He was always in sympathy with his rider and the rider with him, and they readily accommodated each to the other. The change of gait rested each, and they combined to learn them. The walk, fox trot, rack, or single foot, the pace or amble, the gallop, all came in play to rest each and make the journey a pleasure to both. The modern jog or



TOM WONDER.

GENERAL PURPOSE HORSE. Sire, Tom Crowder; Dam by Woodpecker.

spurt with a buggy soon becomes destitute of any thing that enlivens rider or horse. The rider becomes dull and the horse duller, and the work done by each is the merest drudgery. It develops neither horsemanship, nor speed, nor style. It suits a slow-going, lazy man, an idler, or a lout, that has not life or spirit enough to enjoy the gait or style of a spirited saddle-horse. Let us hope that the farmers may return to the better days, when the handy saddle-horse served us better and at far

less cost than now does the mongrel buggy nag, and the rattling road-cart.

The manufacturers of vehicles and the breeders of the trotting-horse have introduced a fashion of buggy riding which has captivated the young men on the farm, and has robbed the country of the grand race of useful horses under the saddle, and saddled on to the farmer an expense for vehicles greater than the horse stock of the farm.

To be sure, the model saddle-horse should never be used for other work. The same is true of the model driver. But the farmer's horse can be both, and do well the work of the farm, too. Even the Clydes and Cleveland Bays, Low tells us, have been found with so open and easy gait as to have led to their purchase for saddle-horses. It is not retrograding to hold fast to that which is good. It is wisdom not to let go of a good thing in mad haste to try a novelty. The writer is by no means wanting in admiration of the noble American trotter, but he thinks the trotter as now bred is not the farmer's horse. He lacks, first of all, the habit of slow, steady going, and is too impatient under restraint. The true trotter loves to go, and his ancestors have been bred for speed and rapid motion, and not for quiet, patient toil, as the plow and wagon horse must needs adapt himself to.

The Trotting-horse.—The trotting-horse is the product of modern times. He did not have his origin in the pursuits of war and of ceremony, as did the Arab and Barb, and their lineal descendant, the Andalusian, and the heavy chargers of the Norman type. The trotting-horse originates in an age when men's thoughts are not mainly on war and pomp, but upon trade and commerce. He is the product of a business age.

Americans have done most to develop the race of trotters, and we hear horsemen that know more of horse than history assert that the trotting-horse originated in America, and that here horses were first trained to trot. While it is true the Europeans and English have done little in developing the trotting instinct and training in that gait, they began to have tests of speed in that gait before it was done in America.

Early Records of Trotting.—As early as 1791 we read of a brown mare, eighteen years old, that trotted on the Essex road sixteen miles in fifty-eight minutes. In 1779 a trial of speed and endurance was made between two geldings on Sunbury Common, England.

We are told that trotting matches at an early day were for distance rather than speed. In 1796 a pair was driven tandem sixteen miles in less than an hour. The celebrated English trotter, Archer, carried two hundred and ten pounds, sixteen miles in fifty-five minutes. About this time, Edward Astley's phenomenon mare trotted seventeen miles in fifty-six minutes, when twelve years old, and her owner offered to trot her nineteen and a half miles in an hour. About 1825 an American horse, called Tom Thumb, trotted one hundred miles in ten hours and seven minutes, in England, including thirty-seven minutes for feed, or actual time, nine hours and thirty minutes.

Whether because of the too heavy vehicles, or of the want of skill among English jockeys in handling trotters, we can not say, but the fact remains that England has not produced trotters worthy of note.

First Trot for Money in America.—Porter's *Spirit of The Times*, of December 20th, 1856, says: "The first time ever a horse trotted in public for a stake was in 1818, and that was a match against time, for one thousand dollars. The horse was Boston Blue, which won by trotting his mile in three minutes. He was purchased by the tragedian, Cooper, who drove him between New York and Philadelphia, enabling him to perform engagements in either city on alternate nights. The horse was taken to England, and there trotted eight miles in twenty-eight minutes and fifty-five seconds, winning a hundred sovereigns. He was a rat-tailed gray gelding, sixteen hands high; of unknown pedigree.

Trotting Clubs Organize.—About 1820 the descendants of Messenger began to attract attention about Philadelphia and New York. In 1825 the New York Trotting Club was organized. In 1828 Hunting Park Association was established in Philadelphia, "for the encouragement of the breed of fine

horses, especially that most valuable one known as the trotter." Three minutes was about the lowest time yet made in England or America. Trots had been for four to ten miles. Now efforts began to be made for the greatest speed for one mile. For several years two and three mile heats were trotted at about two minutes, forty seconds to the mile; then two minutes, thirty seconds; a few could make it in two minutes, twenty-four seconds, and two or three lowered the time to two minutes, twenty seconds.

Among the celebrities we find grand-colts of Messenger, Betsy Baker, Topgallant, Whalebone, Shakespeare, Paul Pry, Trouble, and Sir Peter.

Messenger Family.—A history of Messenger and his descendants would be a fair history of the eminent trotting-horses of the world.

In 1780 Messenger was foaled, and in 1788 he was imported to New York. He had been successful in several races, and had won the King's plate at five years old. Because of his promise and high breeding he was brought to New York to improve the thorough-breds of America at a time when running was more common than trotting. He stood two seasons in Bucks County, Pennsylvania, and was then purchased by Mr. Henry Astor, and kept at Long Island for two years. He was afterwards kept at several places in the State of New York, and one year in New Jersey, at Cooper's Point. He died January 28th, 1808.

Messenger was a gray, fifteen hands, three inches high, and stoutly built. His shoulders were upright, and he was low on the withers, with a short, straight neck, and large bony head. His loins and hind-quarters were powerfully muscular, his wind-pipe and nostrils of unusual size, his hocks and knees very large, and below them limbs of medium size, but flat and clean, and whether at rest or in motion his position and carriage always perfect and striking. It is told of him that the voyage was rough, and three other horses imported with him became so reduced that they had to be assisted down the gang-plank at New York; but Messenger, with a loud neigh, rushed down it,

and in a slashing trot dashed off up the street, with two strong grooms holding him back with might and main.

Here is the vigor and stamina which impressed his descendants, and made him the sire of some of the best running-horses of his day, and the illustrious founder of a family of trotters which the world has not equaled. His illustrious sons, to which nearly all noted trotters trace, are Plato, Engineer, Commander, Why-not, Mount Holly, Mambrino, and Hambletonian.

The Light Vehicle a New Factor.—The thoroughbreds of his get were trained to running, and not used as road horses. In fact, at that day road-wagons had not been made. Good roads were scarce and light vehicles scarcer, nearly all travel being on horseback. Prof. W. H. Brewer in his paper on the evolution of the trotting-horse, shows how important a bearing the improvement and use of light vehicles had on the developement of the trotter.

Messenger blood is not the only element that gave an impetus to the development of speed among trotters about the first of this century. Carriage builders of New Haven say that light buggies with steel springs only became common about 1840 to 1843. Prof. Brewer aptly says: "The introduction of light, one-horse wagons, with steel springs, is coincident with the formation of the first organizations for the breeding, training, and speeding of trotters, and such wagons only began to be common just at the time when we had developed the first 2.30 trotters. Fast trotters had to develop in a country where there was a passion and taste for the animal, and something to make a trotting sulky of; and America is the native land of the hickory as of the trotter. Without hickory to make wheels of, could we have trotters with such low records as we now have? The development of trotters and of vehicles has gone on together. We did not need the fast trotter for driving until we had suitable wagons." With the old, lumbering chariots of Rome, and the clumsy carts of Old England, there was no place for the lively roadster, and no means for track handling and training colts to trot. The creation of light vehicles has helped to develop the American trotter.

The Trotting Ability Discovered.—But, coming back to the influence of Messenger blood on the mongrel stock of the country, we note that the colts of Messenger were used for running horses or the studs. Breeding trotters had not been commenced. The value of Messenger blood in the trotter was a discovery, and not the result of skillful planning. The thorough-bred stock was imported for sporting purposes.

The colonists north of Delaware Bay were religious people, and thought horse-racing smacked of aristocracy and immorality, and breeding race-horses was not encouraged among them so much as south of Mason and Dixon line. Laws against horse-racing became so stringent in the Eastern States that the lovers of good horses found a new means of gratification in the development of fleet roadsters. The fashion of wealthy men driving a single fast trotter, became a powerful factor in stimulating the development of trotters; smart business-men wanted smart business-horses. The light hickory wheels of New England made a light wagon for the road, and a means of pleasure with an active horse of lively gait. The thorough-bred horses on the mongrel stock of the time gave spirit and pluck and speed. The common horse stock of the country came from as many European countries as did the mixed population. England, Holland, France, and Spain furnished the major part. The influence of the French or Norman blood we may note in the Canadian horse, or Canucks. The horses from England were of the heavy draft, in part, but mainly the thorough-bred. The Spanish blood gave the handsome and stylish saddle-horses. But a people of common interests and no aristocracy soon commingled the bloods of the several breeds of horses, and the result was the base for a trotter, on which such grand horses as Messenger, in 1788 to 1808, Mambrino, still later, Hambletonian and Abdallah, all thorough-breds, made their impress.

Description of great Sires.—MAMBRINO, named after the sire of Messenger, was a thorough-bred, a bright bay, sixteen hands high, long-bodied, and like his sire, upright in shoulders. He was not only large, but also a coarse horse, badly stringhalted, as have been many of his descendants. He had a free,

rapid, swinging walk, a slashing trot, and running speed of first order. He was the sire of Betsy Baker, of Abdallah, who sired Rysdyk's Hambletonian, of Mambrino-Paymaster, who sired Mambrino Chief, from whom we have such stars as Lady Thorn. Mambrino Pilot, Bay Chief, etc. This son of Messenger stands at the head as a progenitor of trotters.

Next comes HAMBLETONIAN. He is also a thorough-bred, a dark bay, fifteen hands and one inch high, beautifully moulded, and without a single weak point. He was the sire of Topgallant, Whalebone, Sir Peter, Trouble, and Shakespeare, all ranking among the first of American trotters.

ABDALLAH has many noted celebrities tracing to him. He was foaled at Jamaica, Long Island, in 1826. His sire was Mambrino, his dam Amazonia, a daughter of Messenger. Thus Abdallah was closely in-bred. He was a bay, and plain like his sire, but inherited the trotting quality. He was trained at four years old, and considered the fastest young horse of his day. To be able to say a horse is "out of an Abdallah mare," is enough to commend him to a horseman.

BELLFOUNDER is another imported horse that added something to the trotting power. He was foaled 1817, and brought from England to Boston by James Boot. He was a bay of fine form, size, and action, and transmitted these characteristics to his offspring.

The imported Arabian, GRAND BASHAW, is more largely known, because he was fortunate to have been used on some mares sired by Messenger, when in Bucks County, Pennsylvania.

YOUNG BASHAW, a son of the Arabian, was the first and only one of the whole stock that was blessed with power to trot. His dam was a granddaughter of Messenger.

Diomed Descendants.—The American horses that have become noted as trotters and sires of trotters, and having no Messenger blood, are not numerous. Sir Henry, famous competitor of American Eclipse and Duroc, both descended from Duroc, have transmitted the power to trot to their descendants.

SEELY'S AMERICAN STAR has sired some famous trotters. He

was sired by American Star and out of Sally Slouch, and she was by Sir Henry.

AMERICAN ECLIPSE had Duroc blood, but his dam was by Messenger, which, with many horsemen, accounts for his success in getting trotters.

AMERICUS was of Duroc blood, by Red Jacket, and is not known to have had any other trotting blood. He beat Lady Suffolk in a five-mile match.

Canada Trotters.—We have spoken of the Norman importation into Canada of the larger horses. In Lower Canada, along the St. Lawrence, the horses retain the form and make of the Percheron, or Norman as they were called, because of the Northmen who founded the colony which brought the Norman horses to Canada. They are supposed to have degenerated greatly in size from that of their ancestors of 1608. They are called Canucks. Their color is not regular. Their heads are generally good, face dished, showing gamy disposition, necks well arched, crest often heavy, bodies round and roomy, ribs so sprung as to make a broad, flat back. Their legs are generally good, but somewhat inclined to knee-spring, feet narrow but very durable. They are short, quick steppers, with high knee action; are spirited, trappy-harness horses, and long-lived. The Canadian seems to have gained in pluck and spirit as much as he has lost in size.

PILOT is the most noted one that has ever come to the States. He was a black pacing and trotting horse, whose descendants have great endurance and aptness to trot. He is known as Old Pacer Pilot. He was foaled in 1826. Nothing is known of his breeding. He was bought of a Yankee peddler in New Orleans, about 1832, for one thousand dollars, by Major O. Dubois, and was afterward sold to Mr. Heinsohn, in Louisville, Ky., and kept there until 1855.

ALEXANDER'S PILOT, JR., out of Nancy Pope by Havoc, was the sire of many fast trotters: the fastest of which was

JOHN MORGAN, out of a mare by Medoc, and he by American Eclipse. The dam of Mambrino Pilot was also by Pilot, Jr., and, like John Morgan, was of Messenger descent on the dam's side.

ROYAL GEORGE, the sire of Toronto Chief, was a Canadian horse, not a Canuck. His sire was Black Warrior, and he by an imported horse.

The sons of RYSDYK'S HAMBLETONIAN, Bruno and Brother of Bruno, and their full sister, Brunette, were out of a Canadian mare. They had remarkable speed and powers of endurance.

GIFT, a chestnut gelding by Mambrino Pilot, was out of a small pacing Cannuck mare. At four years old he received five forfeits; his owner challenged any colt of same age to trot in harness, or to a wagon, for \$1,000, and found no taker.

ST. LAWRENCE was a bay stallion of great excellence, and a sire of several fast trotters.

BLACK HAWK, often called VERMONT BLACK HAWK, was foaled in 1833 at Greenland, N. H., was a son of Sherman, one of the best sons of Justin Morgan, the founder of the Morgan family. The dam of Black Hawk was of unknown breeding. He was used for seven years as a carriage-horse in Lowell, Mass., and then was sold to David Hill, of Vermont, in whose hands he sired more high priced colts than any other horse of his day. He was the sire of Ethan Allen, Black Ralph, Lancet, Belle of Saratoga, Black Hawk Maid, Flying Cloud, and many others of great repute. His colts were in great demand in the West and South. It is worthy of note that, notwithstanding the great excellence of his colts, only three of the fifty-two trotting stallions advertised in 1868 are descendants of Vermont Black Hawk, and all of these are part Messenger.

TOM WONDER is another rather remarkable animal, tracing to the Canadian blood. "He is by Tom Crowder, dam by Woodpecker, thorough-bred."

Mambrino Family.—The *Mambrinos* rival the Hambletonians. They descend mostly from Mambrino Chief. He was bred in the East, and taken to Kentucky by James B. Clay in 1854, where he died in 1861. His sire was Mambrino Paymaster by Mambrino, Messenger's best son. He has a numerous and noted progeny, among them Lady Thorn, Bay Chief, Mambrino, Pilot, Eriesson, Mambrino Patchen, Brignoli, Kentucky Chief, Ashland, etc. The pedigree and performance of his get accord.

LADY THORN was noted for speed and bottom, both represented in three lines of descent from Messenger, and three from Diomed, she being almost thorough-bred.

MAMBRINO PILOT is the most distinguished son of Mambrino Chief. His color was brown, his size large and pony built, of matchless form and power, and graceful in every motion and attitude. He inherits three crosses of Messenger, two of Diomed, and one of Old Pilot, through Pilot, Jr.

We might continue illustrations and histories of noted members of the Mambrino family, but space forbids. For the facts and matter given above on the trotting-horse we are largely indebted to Stonehenge and McLure.

Running Blood in Trotters.—At this time there seem to be two schools of theorists as to the element that makes the winning blood among trotters.

One holds that the running horse gives the trotting power in all winners thus far developed. For proof they adduce the fact that every distinguished trotter runs back and is intimately connected with the running horse. Of this school, Wallace is the head.

On the other hand, J. H. Sanders leads the school that holds the trotter of America to be indebted partly and indirectly to the thorough-bred for pluck and endurance, and more directly for the trotting instinct or tendency to the well-developed breed of trotters for which America has become famous. In proof of this they cite cases innumerable almost where trotters have become noted, and have no thorough-bred cross since the days of Messenger, and others that have not had a thorough-bred cross since the days of Mambrino. In fact, recent attempts to improve the trotters of this day by a new cross of thorough-bred have invariably proven disastrous.

The trotting quality has become so well fixed in many families by selection and development, that breeders of trotters to-day, as a general rule, prefer that no thorough-bred blood be found since the days of Lexington or Mambrino Chief. Jay-Eye-See, Phallas, and Majolica are the sensational trotters of 1883.



—Jay Eye See, 5 Yrs Old.—2-10—

SIRE, DICTATOR; DAM, MIDNIGHT.—Owned by J. I. Case, Racine, Wisconsin.

JAY-EYE-SEE is a five-year-old, is by Dictator; dam by Midnight, by Pilot Jr., a son of old pacing Pilot. Dictator, son of Rysdyk's Hambletonian was a trotter and got trotters. He is the sire of Phallas. Phallas does not resemble a runner, but a great trotter. His father was a trotter, so was his grandfather, but his great-grandfather had running blood in his veins, and by this token the through-bred theorists claim him as an example in proof of their theory.

It seems to the writer that it is too soon yet in the history of the development of the breed of trotters to assert positively as to the power of the thorough-bred in development of the trotter. It is true that all the noted families of trotters are indebted to near or remote crosses of thorough-bred blood for valuable qualities. It is also true that the thorough-bred was an important factor in the make-up of the Clydesdale and Cleveland bay, but at so remote a day that no man now claims that the special working qualities of these breeds would be improved by a fresh cross of the speedy race-horse. The next generation of men will see the breed of trotters so well established and fixed that he who would attempt to improve the gait and staying quality of a well-bred trotter of the Hambletonian line by a cross of running blood, would be the laughing-stock of the trotting fraternity. There are successful families of trotters which prove in the stud and on the track their superiority, and the wise breeders are to-day looking to a concentration of this blood rather than to running blood for their success in breeding. Before passing to the table of trotters of the last year, it may not be amiss to notice, in this connection, the death of Governor Sprague. He was foaled at Providence, R. I., in 1871, died of pneumonia at Lexington, Ky., May 5, 1883, cutting short a life of rare promise and great usefulness. He made his first appearance on the track when four years old. He made a public mile that season in 2.21½. Horsemen said his equal had never been seen. In his five year old form he trotted the first half of his third mile at Chicago in 1.08. but was taken up by his driver and jogged under the wire in 2.30. In less than half an hour after this feat Mr. J. I. Case bought him for \$27,500

The table of the new 2.30 trotters of 1883, will help those interested to see where the new-comers are from:

NAME.	SIRE.	SIRE OF DAM.	RECORD
Majolica, b. g.	Startle.	Clark Chief	2.17
Phallas, b. h.	Dictator	Clark Chief	2.18 $\frac{1}{4}$
Judge Davis, b. g.	Joe Brown . . . . .	. . . . .	2.22
H. B. Winship, blk. g.	Aristos	Colonel Moulton . .	2.23
St. Cloud, b. g.	Conklin's Star. . . . .	. . . . .	2.23 $\frac{1}{4}$
Madeline, b. m.	Rysdyk's Hambletonian	Seely's Amer'n Star. .	2.23 $\frac{1}{4}$
Dixie Sprague, br. m.	Governor Sprague.	Pilot Jr.	2.25 $\frac{1}{4}$
Speedress, b. m.	King Philip,	Star	2.25 $\frac{1}{4}$
Blanchard, b. g.	Daniel Lambert.	Young Columbus. . .	2.25 $\frac{1}{2}$
Backman Maid, b. m.	Charles Backman.	Volunteer.	2.26
Prince, b. g. . . . .	. . . . .	. . . . .	2.26
Stephen G., b. g.	Knickerbocker . . . . .	. . . . .	2.26
Mambrino Sotham, blk. h.	Mambrino Gift. . . . .	. . . . .	2.26 $\frac{1}{4}$
Alexander, b. g.	Happy Medium.	Bully King	2.26 $\frac{1}{4}$
Blanche H., blk. m.	Blue Bull. . . . .	. . . . .	2.26 $\frac{1}{4}$
Harry Mills, br. g.	Sweepstakes . . . . .	. . . . .	2.27 $\frac{1}{4}$
Adelaide, b. m.	Milwaukee.	Bay Mambrino. . . .	2.27 $\frac{1}{4}$
Black Jug, blk. g. . . . .	. . . . .	. . . . .	2.27 $\frac{1}{2}$
Western, ch. g.	Tramp Dexter . . . . .	. . . . .	2.27 $\frac{3}{4}$
Kitty Burch, ch. m. . . . .	. . . . .	. . . . .	2.28
Index, b. g.	J. R. Breeze . . . . .	. . . . .	2.28
Erebus, blk. g.	Scott's Hiatoga . . . . .	. . . . .	2.28 $\frac{1}{4}$
Harry Pelham, gr. g.	Thomas Jefferson . . . . .	. . . . .	2.28 $\frac{1}{2}$
Flight, b. m.	Buccaner	Flaxtail.	2.29
Lady Scud, b. m. . . . .	. . . . .	. . . . .	2.29 $\frac{1}{4}$
Bonnie L., ch. g.	Charley B. . . . .	. . . . .	2.29 $\frac{1}{4}$
Sleepy Joe, br. g. . . . .	. . . . .	. . . . .	2.29 $\frac{1}{4}$
Little Miss, b. m.	Goldsmith's Abdallah. . . . .	. . . . .	2.29 $\frac{1}{4}$
Neva, b. m.	Strader's Hambletonian	Tom Strader.	2.29 $\frac{1}{2}$
Fides, ch. g.	General Stanton . . . . .	. . . . .	2.29 $\frac{1}{2}$
Lady Elgin, b. m.	Legal Tender, Jr	Blue Bull	2.29 $\frac{1}{2}$
Wallace, b. g. . . . .	. . . . .	. . . . .	2.29 $\frac{1}{2}$
Maggie F., b. m.	Newry. . . . .	. . . . .	2.29 $\frac{3}{4}$
Mambrino George, b. h.	Fisk's Mambrino Chief . . . . .	. . . . .	2.30
Morocco, b. g.	J. R. Breeze. . . . .	. . . . .	2.30

A Remarkable Trio.—The Chicago meeting of 1883 brought to the front a great trio of horses—Jay-Eye-See, Phallas, and Director—all of them by Dictator. Their's is trotting blood all through, coming from such noted sources as Rysdyk's Hambletonian, American Star, Mambrino Chief, and Pilot, Jr. "There are no near crosses of the thorough-bred, and none are needed." "Trotting blood makes trotters, and running blood makes runners," says the editor of the *Breeder's Gazette*.

The Noted Double Teams.—These noted teams, Maud S. and Aldine, Cleora and Independence, Edward and Dick

Swiveler, owned by wealthy men, have attracted much attention. The breeder of good horses at once asks, "How are they bred?" We answer Maud S., Edward, Dick Swiveler, and Cleora are by sons of Rysdyk's Hambletonian. Aldine is by Almont, his grandson, Independence is by General Knox, a direct descendant of Sherman Black Hawk.

Of the dams of these six noted performers, one was by a son of Rysdyk's Hambletonian; one by Mambrino Patchen, son of Mambrino Chief; one by Henry Clay, Jr.; one by Johnson's Toronto; one by Pilot, Jr., and one said to be by Bacchus. The breeding of such teams is instructive, and shows that breeding in line for trotters gets trotters, and of such rare quality that there is no shadow of excuse for seeking running blood as a new element.

The Element of Running Blood.—The dam of Maud S. was Miss Russell, by Pilot, Jr. She, out of Sally Russell, by the thorough-bred horse, Boston, the sire of Lexington. In this breeding, the thorough-bred claimants find comfort, and generally neglect to say that the sire of Maud S. was Harold, a trotter bred, and an in-bred Hambletonian and getter of trotters. Miss Russell certainly can not be claimed as a thorough-bred, or largely so. She is by Pilot, Jr., and he by Pacing Pilot, of whose blood little is known, but that he was a pacer does not argue thorough-bred ancestry. He got such trotters as John Morgan, 2.24; Pilot Temple, 2.24½; Tackey, 2.26; Tatler, 2.26; Queen of the West, 2.26¼; General Sherman, 2.28¼; and Dixie, 2.30.

But Maud S. had for a dam a mare got by Pilot, Jr. The grand dam, Sally Russell, by Boston, is the animal having thorough-bred blood in her veins. It is hardly good reasoning to give all credit for Maud S.'s good traits to this one thorough-bred cross, while Harold, an in-bred trotter, got Noontide, 2.20¼; McCurdy's Hambletonian, 2.26½; Daciana, 2.27½; Good Morning, 2.28½. Surely in her breeding the trotting blood, so far, outweighs the remote and unimportant sprinkle of running blood, that we may justly infer that there is a prepotency and power inherent in the well-bred trotter, that is to be relied

on as producing trotters, without any modern admixture of thorough-bred blood.

Maud S.—Here we may say further of the history of Maud S. that she is at this writing, February, 1884, still the queen of the turf, though there is a prophecy that Jay-Eye-See will soon reduce her time. She was bred by Mr. Alexander, of Woodburn Farm, Kentucky. When four years old she showed at a public trial on the track at Lexington, Kentucky, October 26, 1878, under the skillful training of Mr. William Baer. It was after this, she was purchased by Mr. Vanderbilt for \$21,000—that is, \$20,000 for the mare, and \$1,000 to Mr. Baer, who was to accompany her to her new home in New York. Under her new master and his driver, she did not prove an agreeable driver. She is remarkable for her will and resoluteness. She is kind to those who treat her kindly, and, in the hands of Mr. Baer, she is ever ready to do her work, and was so gentle that even his wife could drive her. A few weeks' handling in her New York home, gave her the name of being unmanageable and vicious. Mr. Vanderbilt sent word to Mr. Stone, that the mare was not meeting his expectations, and was not reliable. Mr. Stone and Mr. Baer went East at once, to see the cause of the new rôle Maud S. was playing. The mare seemed as much delighted at meeting Mr. Baer and Mrs. Baer in her New York home, as a dog that had found its long lost master. The mare fondled them and pranced about them to express her delight. She was hitched to her wagon by Mr. Baer, who said to Mr. Vanderbilt he would like Mrs. Baer to drive her around the track, to prove that the mare was kind and tractable. But so little faith had Mr. Vanderbilt in the mare's good behavior, that he declined, until Mr. Baer had driven her twice around the track. When Mrs. Baer was allowed the proud privilege of driving her favorite around in a gait that satisfied her owner, the fault was not so much in the Queen of the Turf as in the men who had pitted their wills against hers and been beaten. She has a very strong will, and needs to be handled with great kindness. She comes naturally by it from her grand-dam Enchantress, as well as from her sire,

Harold. He is in resoluteness like his brother Lakeland Abdallah. They all have the courage and resoluteness of a bull-dog. The horses were not so fortunate as the mare, Maud S., in coming into the hands of such a skillful handler as Mr. Baer, who believes that kindness and gentleness will succeed with high-bred horses where force will fail. He believes that Maud S., who has now a record of 2.10 $\frac{1}{4}$, can easily lower it to 2.08.

Horse-will Near to Stubbornness.—But this perverseness of some high-bred animals is only the element which, wisely manipulated, makes them the leaders of their race. It is will-power as well as muscle that sends the winner to the front. The wise horseman is like the wise engineer, who knows the nature of the engine and the steam that gives it power. Wisely manipulated, it works kindly and with unfailing power. Unwisely handled it becomes a reckless tyrant.

GOLDSMITH MAID is another of the trotting celebrities who was unfortunate in her first drivers and owners. Her sire was a son of Hambletonian. One writer says she was sometimes "entirely unmanageable. When hitched to a wagon she would kick herself loose and run away." She was regarded as so very ungovernable as to be practically useless, and her owner, Mr. J. B. Decker, of Sussex County, New York, accordingly sold her for the sum of three hundred and fifty dollars. In taking the animal home the purchaser was offered four hundred dollars for her, which he accepted. She was soon again sold for six hundred and fifty dollars and a buggy, to Mr. Alden Goldsmith, one of the most sagacious, kind, and patient of horsemen. By his patient kindness, he was rewarded in producing a trotter that won her first race in three heats in 2.26, in 1865. The next year she won nine races, when Dexter took the tenth. In 1868 she won eight times, lowering the record to 2.21 $\frac{1}{2}$. The next year she beat American Girl at Philadelphia, in three heats, each one better than 2.20, which was the first record of three successive heats, each less than 2.20. Mr. Goldsmith saw that check-reins and martingale, and blinders all annoyed her, and he removed them. She is described as "small of stature, long

and low, deep through the heart, of wiry, whalebone texture all over, and with a back of amazing strength for a horse of her size. She made a record of 2.14 at Boston, in September, 1874.

Power of Kindness.—She, like Maud S., appreciated a kind friend. The following incident will show how highly an intelligent animal appreciates a kind master or keeper. When she had her foal she was so watchful over it that she would not allow any one to come near it. Her old trainer, Charley Cochrane, had not seen her for two years, and when he went to see her and her colt, it was arranged that she should hear Charley's voice before seeing him. A loud, cheerful whinny told all present that she recognized the voice of her old friend. As soon as he appeared, a touching scene occurred. The Maid, who before had made use of both heels and teeth to drive out every one who dared to approach her colt, left the colt in her eagerness to meet her old friend, and placed her head on his shoulders and her nose in his face and played with his whiskers, and manifested great delight in the unmistakable ways that intelligent animals can express. Her colt came up to be caressed by her mother's friend, and the mare seemed delighted to have Charley Cochrane lay his hand on her offspring. When he left she followed him to the gate, and then looked kindly after him, and called to him after he had passed out of sight. I have taken the space and time to narrate these incidents to illustrate how much greater power the kind and patient man has over the high-tempered and strong-willed horses.

DEXTER was another valuable horse that showed the need of kind and wise handling. He was a son of Hambletonian, but his white feet and blazed face made him less esteemed. At four years old he was sold to Mr. Alley, unbroken. In his hands the horse ran away with a sleigh and then with a wagon, but was fortunate in his next year to fall into the hands of that kind, level-headed trainer, Hiram Woodruff, with whom he soon became famous, and in four seasons won forty-nine races. He made the best mile to the wagon, best mile in harness, and best mile to the saddle that had yet been made.

There are many grand horses worthy of notice herein, but space forbids. As an illustration of what a horse of rare excellence may do for those who may be so fortunate as to own him or his descendants, we will close this paper with one from the *Turf, Field and Farm*.

The Hambletonians.—The money value of the sons and daughters of Rysdyk's Hambletonian that have beaten 2:30 can not be computed. "The stallion himself was purchased with his dam for \$125, and earned in the stud \$205.750. Thirty-six of his get have trotted in 2:30 or better, and the prices for which they could have been sold, in their best days, are as follows:

Dexter \$35,000, Jay Gould \$30,000, Nettie \$25,000, George Wilkes \$25,000, Gazelle \$20,000, Bella \$15,000, Mattie \$15,000, Bruno \$15,000, Deucalion \$10,000, Enfield \$10,000, Orange Girl \$10,000, Sentinel \$10,000, James Howell, Jr., \$10,000, Harvest Queen \$8,000, Lottery \$8,000, Small Hopes \$8,000, Young Bruno \$8,000, Kisber \$7,000, Madeline \$6,000, Breeze \$6,000, Administrator \$5,000, Drift \$5,000, Ellie Deans \$4,000, Ella Madden \$4,000, Lottery \$4,000, Lottie \$4,000, Scotland Maid \$4,000, Chester \$3,500, Hamperion \$3,500, Factory Girl \$3,000, Jerome \$3,000, Maud \$3,000, Alma \$2,500, Astoria \$2,500, Lady Augusta \$2,500, Marguerite \$2,500. This is a total of \$325,000, as a fair estimate of the actual cash value.

The stallions in the list, which have won renown in the stud, are Sentinel, George Wilkes, Jay Gould, and Administrator. Their united progeny is worth a great many thousand dollars. George Wilkes, for instance, is the sire of twenty-six 2:30 trotters, including Wilson, 2.16½; Rosa Wilkes, 2.18½; Joe Bunker, 2.19½; So-so, 2.17½; and May Bird, 2.21. Sentinel has eight 2:30 performers to his credit, among them Von Arnim, 2.19½. The fastest of Jay Gould's get is Adele Gould, 2.19, and the best one from the loins of Administrator is Catchfly, 2.19. The entire sons of Hambletonian which have no place in the 2:30 circle, but which have been successful in the stud, are very numerous. Alexander's Abdallah was sold for about \$3,500, but he got Goldsmith Maid, who made a record of 2.14,

and whose turf winnings foot up close to \$250,000; Thorndale, who gained a record of 2.22 $\frac{1}{4}$, and from whose loins came Edwin Thorne, 2.16 $\frac{1}{2}$, and Daisydale, 2.19 $\frac{3}{4}$; Almont, the sire of twenty-two 2.30 trotters, including Fannie Witherspoon, 2.17; Piedmont, 2.17 $\frac{1}{4}$; and Aldine, 2.19 $\frac{1}{4}$; and Belmont, with nine sons and daughters with records of better than 2.30, among them Nutwood, 2.18 $\frac{3}{4}$, and Wedgewood, 2.19. The descendants of Alexander's Abdallah are worth hundreds of thousands of dollars. Volunteer stands in the very front rank of the producing sons of Hambletonian. He has to his credit twenty-three 2.30 performers, one of which is St. Julien, 2.11 $\frac{1}{4}$, who at one time could have been sold for \$40,000. Before age had diminished the lustre of Volunteer's eyes, Mr. Goldsmith would not have parted with him for \$30,000. When Messenger Duroc's stud fee was \$300, Mr. Backman refused a very large sum for the stallion, and he would not sell Leland for \$20,000. The price paid for Happy Medium, when he was sold to Mr. Steele, was \$25,000; and Mr. Bonner paid \$20,000 for Startle, sire of Majolica, 2.17. Electioneer proved a very cheap horse to Governor Stanford, who gave Mr. Backman \$12,500 for him. He is the sire of the fastest yearling, 2.36 $\frac{1}{2}$; the fastest two-year-old, 2.21; the fastest three-year-old, 2.19 $\frac{1}{2}$, and the fastest four-year-old, 2.18 $\frac{3}{4}$; and \$30,000 would not buy him now. Dictator is the sire of the three sensational performers of 1883 — Jay-Eye-See, 2.10 $\frac{3}{4}$; Phallas, 2.15 $\frac{1}{2}$, and Director, 2.17—and when twenty years old he was sold for \$25,000. An offer of \$30,000 for him would not be accepted at Ashland to-day. Harold, sire of Maud S., 2.10 $\frac{1}{4}$, is valued 'way up in the thousands at Woodburn, and so is Cuyler, at Glenview. General Withers paid \$5,000 for Aberdeen when he took him to Fairlawn, but this was nothing like his value. Prominent among his ten 2.30 performers are Hattie Woodward, 2.15 $\frac{1}{2}$, and Modoc, 2.19 $\frac{1}{2}$. The progeny of Edward Everett, Middletown, Walkill Chief, Dean Sage, Knickerbocker, Seneca Chief, Strathmore, and Rysdyk (sire of Clingstone, 2.14) are worth a stack of money." In view of such a showing, is it wonderful that American breeders of trotters are enthusiasts in their business?



Table of Best Records.—Professor Brewer, of Yale College, has kindly furnished the following table, which shows how time has been lowered :

1806. Yankee,	2.59	1865. Dexter,	2.18½
1810. A horse from Boston,	2.58½	1866. Dexter,	2.18
1824. Topgallant,	2.40	1867. Dexter,	2.17½
1824. The Treadwell Mare,	2.34	1871. Goldsmith Maid,	2.17
1830. Burster,	2.32	1872. Same,	2.16¾
1834. Edwin Forrest,	2.31½	1874. Same,	2.14
1843. Lady Suffolk,	2.28	1878. Rarus,	2.13½
1844. Same,	2.26½	1879. St. Julien,	2.12¾
1852. Tacony,	2.26	1880. Maud S.,	2.10¾
1853. Same,	2.25½	1881. Maud S.,	2.10½
1856. Flora Temple,	2.24½	1884. Jay-Eye-See,	2.10
1859. Same,	2.19¾	1884. Maud S.,	2.09½

The Russian Trotter.—The Orloff trotters of Russia have gained such notoriety for speed, endurance, and style that they deserve a brief notice here. The name is from that of Count Alexis Orloff. Tschesmensky was an enthusiastic horseman of Russia, who, as the *Live Stock Journal* says, as early as 1775 imported from Arabia a gray stallion named Smetanxa, said to be of unusual size and strength. A Danish mare was bred to this stallion, and the produce was Polkan 1st. This half-blood was bred to a Dutch mare, begetting Bars 1st, generally known as the progenitor of the Orloff race of trotters. The fame of Bars 1st was perpetuated through his sons Lubeznay 1st, Lebed 1st, and Dobroy 1st. Count Orloff and his successor, V. T. Shiskin, by selection from the get of these stallions and crossing with choice English and Dutch mares, founded a race of mixed origin. Count Orloff was an intelligent enthusiast as a breeder. He had ample means to gratify his taste and keep together his entire horses, and dictate crosses to meet his approval. Death cut short his work, and his stud was scattered. Several private studs were established, and a considerable portion of it passed into the hands of the czar.

Although the question of what constitutes the best trotting pedigree has not been decided, a stud book has been instituted to keep the breed pure. For fifty-three years the crown has fostered the breeding of Orloff trotters, and has furnished more than half the prize money of the race-course as a means of developing and testing the powers of these horses. Russian trials of

speed are regulated by law, and a violation of the rules will land the culprit in Siberia without much delay. The time made by the Orloff trotters does not equal that of the American trotters.

BEST RUSSIAN TIME UP TO 1874.

One mile,	. . . . .	2.31
Two miles,	. . . . .	5.01 $\frac{3}{4}$
Three miles,	. . . . .	7.52 $\frac{1}{2}$
Five Miles,	. . . . .	13.56 $\frac{3}{4}$
Twenty miles,	. . . . .	68.53 $\frac{1}{2}$

BEST AMERICAN TIME PRIOR TO 1874.

One mile,	. . . . .	2.14	Difference,	. . . . .	00.17 sec.
Two miles,	. . . . .	4.50 $\frac{1}{2}$	Difference,	. . . . .	00.11 $\frac{1}{4}$ sec.
Three miles,	. . . . .	7.21 $\frac{1}{4}$	Difference,	. . . . .	00.31 $\frac{1}{4}$ sec.
Five miles,	. . . . .	13.00	Difference,	. . . . .	00.56 $\frac{3}{4}$ sec.
Twenty miles,	. . . . .	58.25	Difference	. . . . .	10.28 $\frac{1}{2}$ sec.

The Orloff trotters lack in campaigning power, or the Russian does not know how to groom and handle them.

The oldest Orloff winner is twelve years, while Goldsmith Maid was in her prime at twenty, and most of our great trotters steadily improve until twelve to sixteen years old.

The Russian trotters seem to have attained the maximum of their powers several years since, while the American is still lowering his record, and since the days of Boston Blue, the first trotter making a mile in three minutes, the time has been gradually lowered, until Maud S. and Jay-Eye-See have nearly reached 2.10, and their owners confidently expect the record of 1884 to go down to 2.08. The Russians claim that the Orloff trotter has more style and finish than the American trotter. But this is not granted by Americans who have seen both. In colors they surely do not excel our trotters, and in speed they can not compare, nor in lasting energy and long usefulness. Some one has classified their winners by color, which shows fifty-five per cent of grays, twenty-four per cent blacks, fourteen per cent bays or browns, and six per cent light bays.

The elements of blood and power are found in the American trotter in such high excellence as to place them at the head of

all trotters. From a study of the horses named and their characteristics, one may readily see that the best horses are not obtained by accidental breeding, and the best performers in harness and on the track have the double benefit of choice breeding and skillful training. Such phenomenal trotters as Goldsmith Maid and Maud S. illustrate the value of good breeding and skillful kind handling.

Ponies.—The origin of ponies is unknown. The Hebrews, Greeks, and Romans have no name for them, if they had any knowledge of them. The ass among the ancients filled the place which the better class of ponies were suited for. The pony can not be regarded as the dwarf of any breed of horses, for the species seems wholly unable to produce horses, as horses are to produce ponies. They appear to have originated in extreme latitudes either of heat or cold, such latitudes as the horse does not seem indigenous to, and where, if imported, he would degenerate in size.

Shetland Ponies.—This is one of most distinct types of European ponies. Ponies are found on Shetland Isles, in Northern Iceland, in Sweden, Scotland, and Wales, which seem to be of same origin, and stunted and dwarfed by the cold and scanty fare of their habitat. The Cossack horse found in Russia seems to be a dwarf horse of good Turkish blood, reduced in size by hardship and severity of climate, yet like all the others, has lost none of his spirit nor ability to endure toil, hardship, and spare diet. The Cossack and Shetland can endure labor on comparatively less feed than any animal known.

The Mustang and Indian Pony.—Herbert believes the mustang of Mexico and the Indian pony of North America to have originally descended from European breeds. They are now distinct breeds. Though they are tough and fiery and often vicious, yet they are in every respect inferior to the American horse, and can be ridden down by a troop of good horsemen. They have no uniformity of color or form. They are useful on the cattle ranches and plains under the saddle, but they are not to be desired either for driving or farm work. Unless taken young, the mustangs are intractable and



THE FALSE START.

often vicious. And this is just what should be expected from their origin and use. They doubtless descend from the horses left by the early Spanish adventurers. Here the mustang started in hardship, and has ever been used to scanty fare, hard usage, and bad handling. They have none of the marks of civilized usage. To know just where to draw the line between the mustang and Indian pony is difficult. The pony of Canada and the mustang of Mexico seem to be animals of more merit than the Indian pony, and have shown more power to endure and perpetuate than do the Indian ponies. The latter, like their masters, seem to be declining before the touch of civilization.

CHAPTER II.

THE HORSE—BREEDING.

BREEDING of live-stock has for centuries been a subject of vast interest to men engaged in raising horses, cattle, sheep, or swine. For the most part, its success has come to but a few gifted men. These few have had intuitions and not scientific laws to guide them. The great law of every animal bringing "forth after his kind" was proclaimed with its creation. Man at an early day modified it by saying "like produces like." As man advanced in knowledge, gained mostly by experience, and the observations of some individual careful observer, he gave as a corollary of the old law, "breed from the best."

These aphorisms represent the fundamental principles of the best modern practice. The trouble all along the line of history is to find a general agreement among the men who own animals as to what is the "best." Men's ideals are subject to the uses to which they put their animals. The men of early ages used horses for purposes of war and ceremony. They used them wholly for the saddle, and the animals were selected for centuries which best met the ideals of the warriors for purposes of battle and parade. The nomadic tribes have a kindred use for horses, and add that of the chase. For all these uses we find men in earliest periods of the history of the horse selecting them for speed and endurance.

Jacob a Color-specialist.—Father Jacob is the first breeder on record who bred for color as well as vigor. He showed great shrewdness in his attempts to control the color of the calves in Laban's herd. He is the first color-specialist on record. How well he fixed a type of color, history does not inform us, yet so

long as he made that a specialty he had success, and thus beat Laban out of the majority of his flock.

Jacob understood a basis fact in the art of breeding. "Whenever the stronger cattle did conceive," he sought by his arts to have their offspring of his favorite colors. Thus we are told "the feeblers were Laban's, and the stronger Jacob's." He increased his flock from the *strong* and his father-in-law's from the *weak*, and soon Laban's sons saw the man Jacob "increased exceedingly," and they said, "Jacob hath taken away all that was our father's." He illustrated the value of the law, "breed only from the best," and he meant by that the "strongest." He also illustrated the law announced by Darwin, viz., that of *selection*. Darwin has shown, too, that the great improvements made in domestic animals have been made by selection of one point, and breeding to fix that. Jacob bred for color, and to aid in fixing that he sought first the *strongest* animals, and fixed the color trait in them, and it naturally followed that their get would be of the desired color.

Bakewell Bred for Quality.—Bakewell, of England, in the last century went farther in the application of the law that "like begets like," and did not limit his selection to a general likeness between parent and offspring, but extending the law to the minutest details, he set up a clear ideal or definite standard of excellence for Leicester sheep, Long-horn cattle, and Black cart-horses, and his system of selection proved him to have wonderful ability as a breeder. He regarded these animals as machines for converting the grass and grain of his estate into flesh, wool, milk, and force of greater value. He esteemed as "best" the animal that furnished the largest amount and best quality of animal product from a given amount of food consumed.

Some men have varied this law erroneously to mean the best horse or cow is the one that consumes the least. The animated machine which will convert the largest amount of raw material into the desired paying product with least possible wear and expenditure of fuel or feed, is the most profitable. The amount of feed consumed must be measured by the amount of force or animal product produced. The raw-boned work-

horse, may consume more feed than his mate, and yet if labor is the test of value, he may do enough more work to pay the better price for his feed, and *vice-versa*. The question is not so much as to amount consumed, but as to what use it makes of it in producing flesh or force. The art of breeding we may say has for its ultimate end, the development of animals in the lines that will yield best returns for feed and care given.

Heredity a Fundamental Principle.—The foundation of successful breeding rests on the law of *heredity*. That such a law exists in the order of nature is to be concluded from the regularity with which animals in a state of nature produce their kind. The wolf produces only a wolf, with none of the quiet, gentle traits of a lamb or a pet dog. The wolf of to-day is essentially like that of fifty or a hundred years ago. The animals on the monuments of Egypt are essentially the same as those now found along the Nile.

When, however, man comes into the business of breeding, or controlling connections of animals, we find the types of succession begin to vary. The wolf bred to the dog produces an animal in some degree like a wolf, but modified by the characteristics of the dog. We call the produce a mongrel. If we cross this mongrel again with a wolf, the produce is more wolfish than the mongrel, and if crossed with the dog many times in succession, we may, in the course of years, circumvent the law of nature that would produce a wolf from a wolf. Every time the cross is made with the dog, the wolfish tendency is weakened, and the probability of the offspring taking the fixed type of the dog is increased. But so strong is the law of heredity, and so firmly has the wolf's nature been fixed by centuries of wolf-breeding, that with all man's efforts to destroy that tendency to produce an animal of the wolf-kind, the wolfish traits are ever cropping out.

Atavism Beneficial.—This reversion to a type of a former ancestor is called *atavism*. It is at once a difficult thing to control, and at the same time a beneficial thing, when we have so long a line of desirable ancestry established by long-continued good selection as that the chances of breeding like some former

ancestor will usually hit the likeness of a good, rather than an inferior ancestor. When the long line of ancestors is unknown, and no history of them is recorded, we can have no idea what the offspring will be like. The chances are that inferior ancestors predominate in common or scrub stock, and if the laws of heredity and reversion mean any thing, we may expect little or no improvement of stock by using for sires and dams animals of such mixed and unknown breeding. If it be true that the character of the offspring is affected by that of the ancestry, then it follows beyond question that we may not hope for desirable types of progeny from undesirable lines of ancestry. We do not expect figs from thistles, or lambs from wolves, or pure waters from impure fountains.

The Value of Pedigree.—If the principles set forth are true, then the breeder of fine animals must know the character of the animals and families represented in the ancestral lines of his breeding-stock, if he would breed with any intelligence. The value of such knowledge is recognized by all intelligent and experienced breeders. But they all realize that the knowledge yet obtainable from stud-books, records, and registers of breeding is very imperfect. First, because few records or registers have been kept long enough to afford a line of descent to the several families that has been fixed and intensified by repeated use of good ideals or representatives of the breed. The Stud-book of English Thorough-breds is the oldest record, and it abundantly illustrates the principle of accumulating power of repeated good crosses. Second, the imperfect and incorrect statements placed on record lead to errors; some the result of ignorance of the facts, others the result of willful misrepresentation. But knowledge is cumulative and deception is not tolerated among the true students of any science. Errors in fact are ruinous to correct conclusions, and the student of lines of ancestors wants to know the true nature and ability of ancestors before he can calculate what he may expect from a given cross.

The trotting-records are, year by year, becoming more valuable. Like wine, the older, the better. Each fermentation or working throws off some impurity, and the residue is more pure

and reliable, yet the taint of impurity is never wholly eliminated. The value of records is recognized by all men engaged in breeding and improving any of our domestic animals. . The fact that the compilation of stud-books is subject to the influence of human ignorance and dishonesty does not prevail more against them than against any other class of writing made by man. They are all imperfect, yet we can not do without records of knowledge, though they are mingled with error.

The Earliest Records.—The breeder of thorough-bred horses has an unbroken record back to the time of James I. The Arabs took great pains to preserve their breed of horses pure, and have the credit of first establishing pedigrees; but as these were traditional, they are not so reliable as those of the English race-horse, nor to be compared with the faithful records now made of the American trotter, the Percheron, Clydesdale, and others. Breeders of all pure-bred animals are beginning to appreciate the value of well-kept records, and have generally formed associations for that purpose. Secretaries and committees are employed to inspect all pedigrees offered for record. Their accumulated and fast increasing knowledge is leading to wonderful skill and accuracy in the work. Well-kept records of every noted breed of horses, cattle, and swine are so well established, that there is no longer any excuse for negligence or ignorance in the matter of breeding of any family used in the herd.

The value of pedigree, or knowledge of ancestral lines, was recognized as far back as the time of Augustus, when Virgil wrote :

“The brave begotten are by the brave and good;
There is in steers', there is in horses' blood
The virtue of their sires. No timid dove
Springs from the coupled eagles' furious blood.”

High Breeding more than Appearance.—“On the turf,” says Stonehenge, “high breeding is of more consequence than external shape, and that of two horses, one perfect in shape, but of an inferior strain of blood, and the other of the most winning blood, but not so well-formed in shape, the latter will be the

most likely to perform to the satisfaction of his owner on the race-course. On this principle the proverb has been framed and handed down to us, that 'an ounce of blood is worth a pound of bone.' The same able author, however, would not allow this remark to go without the limitation: 'but there must also be a frame of the most useful character, if not always of the most elegant form.'"

Breeding Back or Atavism.—The persistency of the law of heredity is seen in the constant tendency of animals to breed back to some remote ancestor. Here is the discouraging feature to every man who would found or improve a newly founded breed of horses, cattle, or swine. The race-horse has been prized as a foundation for trotting-blood. It gave life, pluck, and staying qualities to the produce, qualities so essential in the generation of trotters. But with these came the tendency to break into a run, when the contest is hardest.

Breeding for Color of Short-horn Cattle.—The breeders of the fashionable red short-horn cattle have found a constant liability of even their most fashionably bred cattle to drop roan, or red and white, or even white calves, although dam and sire might both be of solid red color. The early breeders of short-horn cattle on the Valley of the Tees were intent first on developing form and quality, and the color was a minor point. After generations of careful breeding for quality and form, they began to attempt fixing the color. Here was a new factor, and the breeder seeking to fix it must not lose sight of the royal ancestral lines which gave the superior qualities to the short-horn breed. To secure the greatest number of good calves they soon learned that the ancestor having the greatest number of best crosses gave the largest per cent of desirable calves; and yet, there was in all the working for the red color an ever recurring tendency to breed back to the now unfashionable colors of some grand old ancestors.

Breeding for Color of Berkshire Swine.—The swine breeders find the same law at work among their breeds. The Berkshire men find occasionally some pigs with a rusty or sandy spot appearing among the litters, which so generally are marked

with such amazing uniformity. The unskillful breeder suspects the spot as telling of impure blood. This may be true or not. The reputation of the breeder and a study of his pedigrees will settle that, and show that the spot is but a case of atavism. The Berkshires of forty years ago had these rusty or sandy spots, and the expert to-day knows that he may occasionally have a pig with a rusty spot or even a lop-ear, as had the ancient Berkshire. But skillful breeding reduces the power or tendency to atavism, to such a degree that in the best families of this breed we expect confidently pigs of a standard color.

The Law Essential to Improvement.—This law of breeding back has its advantages. In fact, it is essential to all improvement. If there were no tendency to breed back to the form, color, or qualities of ancestors, where could we have found the thousands of horses marked with Messenger traits. Where and how could we have collected and concentrated the Mambrino blood, and the Hambletonian among trotters, until to-day we have families whose prominent characteristics are those of their great ancestors. They all excel as trotters.

Breed for a Special Purpose.—In 1818 there was only one horse known that could trot a mile in three minutes, and that was Boston Blue. In the run of fifty years we have produced thousands of horses that could trot as fast as Boston Blue, and two hundred and forty-five that could trot better than 2.30. In ten years more, by 1878, we had one thousand and twenty-five that could trot better than 2.30, and over five hundred horses that trotted below 2.25, and some as low as 2.15. By 1888 we may confidently expect to see two thousand beat 2.25, and some go as low as 2.05. Notwithstanding at this writing in 1884, Maud S. has come down to 2.104, and Jay-Eye-See close after her. And all this has been done by breeding for a special purpose. The best bred trotters have produced the greatest number of winning horses, just as is true of the English race-horses cited by Stonehenge.

American Farmers Not Careful Enough.—Farmers generally ignore the question of breeding and blood of their

horses. If the mare is too mean to work or broken down in constitution, she will yet produce a colt, perhaps, and is bred to the nearest and cheapest horse, regardless of qualities or breeding. The result is, we farmers have done very little for the improvement of our horses. Horsemen must have the credit of bringing to us good horses and pressing us to use them. Even in this accidental way we find in some districts that occasionally a horse of rare excellence as a foal-getter has caused a marked improvement in the common stock of a neighborhood. Iron's Cadmus is one of this kind, that made so much improvement in the horses of Warren and Butler Counties that the value of his service to these counties can not be estimated. But he was not only an exceptionally good horse, but one of high breeding. On the common farm mares he produced an excellent class of general-purpose horses.

But that is not enough. To insure highest results we must continue from year to year and generation to generation, breeding from and to the best specimens of the class that we are breeding for. If we wish trotters we must not use the draft-stallions. If we want coach-horses we must not breed to mustangs. If there be any force in the law "like produces like" we must not hope for an accidental setting aside of its power in our favor when we breed a mongrel to a scrub, and hope for a winner on the turf. The farmers need speedily to correct their views on this matter of breeding, if they would improve their stock of horses.

English Farmers More Successful.—The English breeders and farmers have made greater progress in the art of breeding domestic animals than have we in America, as is shown by their numerous and well-defined breeds of animals. For example, among their horses we note the thorough-bred; then by use of heavy, large, bony thorough-breds on good, strong, fairly well-bred mares, we see them producing their hunters, and coachers and cobs and nags. Then in some districts we find them fixing and developing such well-defined types of animals as the Shire draft, the Black cart, and Cleveland bay. Among cattle they have the short-horn, the Devon, the Hereford.

Among sheep, the Shropshire, the Oxford and South-downs, and Hampshire-downs; then come the long-wools, the Cotswold, Lincolns and Leicester, etc. In every class of domestic animals they seem to recognize the value of breeding for a special purpose, and breeding in line, until the type wanted is obtained.

Breeding for Increased Size.—As a rule the farmer's horses in America are too small. This arises from two great and leading causes. First is the habit of allowing the young things to shift for themselves; second, the want of any uniform effort towards increase of size by judicious crosses. When an occasional farmer attempts to breed for increased size, we find him taking his little, light-boned mares, to some ponderous beast, noted for his size and avoirdupois only. His owner's chief card is the horse weighs so many hundreds more than a ton. On this point of increasing size, consider of what possible use can be a vast carcass on a weak set of limbs, deficient in quality and shape of bone.

Increase Size Gradually.—There is no safety in such violent crosses. Nature works gradually in her developments. If we would increase the size of our farm-horses, and we have on hand mares that weigh from one thousand to eleven hundred, we should select not the largest specimens of some of the heavier draft breeds, but rather well formed, powerfully and uniformly made horses, with strong bone, well-knit joints, and the best of feet. On such legs we may lay an increased carcass without fear of spavin and corbs, and puffed joints. The next cross may be to a larger horse with like characteristics of form, bone, and joints. The crossing of lightly built mares on these enormously large, clumsy horses has been prolific of a large per cent of ill-shaped and blemished colts and horses, abounding in bog-spavin, thorough-pin, crooked or clubbed feet. The increased carcass must be well supported by a like increase of strength in limb, or we shall have an ungainly, spongy, and clumsy lot of colts.

The increase of size may be reached first by breeding blocky, squarely built, strong mares that are good sucklers, to the larger

breeds of horses, and then by a reform in the method of raising colts. From the starving plan we must advance to that of liberal feeding of the young. Of this we shall have more to say under the care of colts.

Breeding for Docility.—The farmer's horse should above all be of a docile temperament. He must be patient under a load, plucky enough to keep courage under hardships, and spirited enough to save the need of constant urging, and intelligent; to adapt himself readily to the great variety of uses to which he must be put, in the furrow, at the wagon, and on the road. It is evident, then, the farm-horse must be docile, with all his other qualities. All of these will be the more valuable as he may have a higher degree of docility. Even the roadster, the gentleman's, or family driving horse, or the trotter on the track, has greatly increased value by reason of a level head or a docile disposition.

There has been too little attention paid to this trait in our breeding American trotters and English race-horse and farm-horses. In this respect these breeds are far behind the true Arab, or the grand Percheron. While we have outstripped them in the race, we have neglected caring for the temper. We need a reform in this.

Some of the most noted trotters have been vicious and obstinate. A firm will and resolute heart are essential for the horse that must meet and overcome his antagonist, and there is but a step between resoluteness and obstinacy. The colt may be heady and self-willed, yet by kind handling in youth he may be led to have no higher motive than the will of his master. This can be attained only by kind handling. The temperament and condition of the ancestry is an important factor, which the wise breeder will not lose sight of.

Vice Follows Vice.—There is a custom of putting a fiery, vicious filly to the horse to soften her down before attempting to work her. There is also a custom of breeding from mares that have never looked through a collar, or been broken to stand hitched by a halter. The condition of these mares at the time of service, when brought to the horse is that of excitement and

irritation, and not of obedience and yielding to the rule of man. In the field or pasture they have fought their way with their teeth or heels, and have taken to flight at the sight of man or the sound of his voice. Now, if there be force in the law of inheritance of natural and acquired traits, what can we expect but perversity and nervousness in the offspring of such mares?

Work the Breeders.—The Arabs handled their colts from the moment they came into the world. Their children played with the colt and dam as with the pet dogs. The mares were handled by the Arab with greatest kindness, and the mare, like the stallion, was always brought under such complete control of the master that they had no will but his.

The French draft-mares and stallions are all worked. They begin to earn their feed at two years old, and the stallions are under such control, by daily handling and work, that they are as quiet and kind to handle as our geldings. The stallion of America, on the other hand, is kept in a close stall, highly fed, seldom exercised, and that without regularity. The more spirited the horse the more impatient he is for that exercise his nature demands. He is nervous and often unmanageable, merely from want of the exercise the animals of activity and power must have to preserve their highest vigor, and an equilibrium of their vital and nervous forces. Is it strange that animals in their condition, and that of the untamed and untrained mares, should beget nervous, restless, and even vicious offspring?

Evils of Confinement.—There is another evil attending this confinement and effeminate handling of sires and dams, from which we look to get hardy and vigorous colts. The colts are lacking in vigor and stamina. They are too often feeble in infancy, and need extra care to raise them.

The remedy for each of these evils is found in a rational and regular handling and daily working of sires out of the breeding season, and of the mares at least eight months of the year. Our methods of handling stallions are not in harmony with physiological laws. The effeminate women of wealthy and luxurious homes, who know nothing of the value of muscles strengthened and appetite whetted by honest and regular toil

in-doors or out, bear a puny and feeble offspring compared with the young of the women who are accustomed to regular work, or to the women in the Indian tribes, who know nothing of the pains of civilized and effeminate matrons. We can economize in the keep of our stallions and mares, and increase the value of their offspring by regular work.

Endurance may be Increased.—For the farmer or the professional man, for the turfman or business man, the great powers of endurance enhance the value of his horse. This power will not be lessened, but rather increased, by habitual and regular labor of dam and sire. A few generations of breeding from such animals will prove the value of it. A colt born in feebleness, of feeble ancestry, and with light heart and thin chest, may never reach a period of usefulness or value.

Family Trait Important.—*The Strain of the Family* has more in it to tell of enduring powers than form or temperament, or handling or keep. To insure great endurance we must select mares of power and staying qualities, and sires of rare ability here. Messenger's unequalled vitality enabled him to impress this valuable trait on his long line of offspring. The get of Eclipse were also noted for this quality, like the noble sire.

The Effect of Short Races.—Instead of reducing the distances of races, to suit the enfeebled blood of track-horses, let us ask that the distances be kept long, and even increased, until the weaklings that are winners, perhaps, on a quarter, shall be driven into exile or to the tan-yard, by an increased length of the race-course. The long races will weed out the families that lack staying powers.

Since the getters of prize-winners have so great influence through their get on the horses used in business and on the farm, we look on this tendency to reduce the length of races as a public calamity. It increases the number of second to fifth-rate horses and jockeys, that can multiply indefinitely as the course is shortened to meet the enfeebled condition of their horses. Just that class of horses and the class of men that use them for sporting purposes, degrade the business of handling trot-

ting and running-horses, and demoralize the race-tracks, and curse the horse-business generally. They wear out smart mares by hippodroming the circuits, and then breed their remains to some cheap stallion of like qualities, and the produce is usually of no more value than the ancestors or owners.

In-and-In Breeding.—This term is generally used to mean the breeding of animals that are nearly related. There is wanting among farmers and breeders generally a clearly defined idea of its meaning and of its use. The results of close marriages in the human family, persisted in from generation to generation, have been so disastrous that there is a common idea that animals nearly related should never be bred together. This is not founded on a large acquaintance with the methods of the most successful breeders of all kinds of domestic animals.

Improvement of animals comes by increasing, and even fixing, the traits of excellence sought. If speed be the trait sought, and a given family excels all others, then by crossing sire on daughter, or son on dam, we double the chances of the offspring having that trait of excellence which marks the family. On this principle, horses that have the greatest number of Messenger crosses have excelled as trotters. They have not only had speed, but much of that nerve and resoluteness which carries them to the front.

Defects Inheritable.—If the family excelling in speed has marked defects or objectionable traits, as corby legs, thickness of wind, or weakness of eye or loin, then an attempt to repeat crosses of this family is attended with too great risk, for the law of inherited traits is as strong, or stronger, in regard to defects as excellences. It may be laid down as a rule, that in-and-in breeding must not be practiced in families possessing prominent objectionable traits. Animals of ideal types are few. Hence, when found, how can their like be produced again, but by breeding to those of like blood, so near as may be found.

Close Breeding.—It is on this principle that Bakewell established the Bakewell Sheep and Longhorn Cattle, and Collings their improved and world-renowned Shorthorns. The Booths practised close breeding of their cattle to a great extent,

as the pedigrees of their most noted animals show. Miles tells of the calculations of Rev. J. Stone, which show "Crown Prince is 1055 times descended from Favorite, and Red Rose, by Harbinger, is descended 1344 times. So the produce of the two are descended from him 2399 times." The Hereford Cattle are now coming into notice as a most hardy breed, yet Mr. Tompkins asserts that he has bred his herd "in-and-in for upwards of eighty years." We quote the above as an extreme case, and yet the cattle of the breed whose type has been so fixed are noted for strength and vigor of constitution.

In-and-In Breeding a Necessity — We might also show from the breeding of many of our most noted horses that are rich in the blood of some noted ancestor. The sire and dam of Abdallah were both by Messenger; so the sire and dam of Hambletonian. "The effect of breeding blood-relations together has been much discussed. Physiologists condemn the practice among human beings, while breeders of live-stock have approved it among all domestic animals so far as is necessary to fix a type."

Stonehenge says: "When any new breed of animals is first introduced, in-and-in breeding can scarcely be avoided." In his *British Rural Sports* he gives a series of examples of breeding, and then concludes, "that in-and-in breeding carried out once or twice, is not only not a bad practice, but is likely to be attended with good results. Let one ask what horses have been the most remarkable of late years as stallions, and with very few exceptions he will find they were considerably in-bred."

In-and-in breeding, however, is not to be encouraged among men not thoroughly versed in the lines of breeding and the art of selecting and mating.

General Principles of Breeding.—As this work is to go into the hands of farmers who breed all kinds of domestic animals, it may be well here to insert the "general principles of breeding," as presented by Stonehenge.

1. "The union of the sexes is, in all the higher animals, necessary for reproduction; the male and female each taking their respective share."

2. "The office of the male is to secrete the *semen* in the *testes* and emit it into the *uterus* of the female, in or near which organ it comes in contact with the *ovum* of the female, which remains sterile without it."

3. "The female forms the *ovum* in the *ovary*, and at regular times, varying in different animals, this descends into the *uterus* for the purpose of fructification, and receiving the stimulus and addition of the *sperm-cell* of the semen."

4. "The semen consists of two portions, the spermatozoa, which have an automatic power of moving from place to place, by which quality it is believed that the semen is carried to the ovum, and the *sperm-cells*, which are intended to co-operate with the germ-cell of the ovum in forming the embryo."

5. "The *ovum* consists of the germ-cell intended to form part of the embryo, and of the yolk, which nourishes both, until the vessels of the mother take upon themselves the task, or in oviparous animals, till hatching takes place, and external food is to be obtained. The ovum is carried down by the contractile power of the fallopian tubes from the ovary to the uterus, and hence it does not require automatic particles, like semen."

6. "*The embryo*, or young animal, is the result of the *semen* with the *ovum*, immediately after which the *sperm-cell* of the former is absorbed into the *germ-cell* of the latter. Upon this a tendency to increase or 'grow' is established, and supported at first by the nutriment contained in the yolk of the ovum, until the embryo has attached itself to the walls of the uterus, from which it afterwards absorbs its nourishment by the intervention of the *placenta*."

7. As the male and female each furnish their quota to the formation of the embryo, it is reasonable to expect that each shall be represented in it, which is found to be the case in nature; but as the food of the embryo entirely depends upon the mother, the health of the offspring and its constitutional powers will be more in accordance with her state than with that of the father; yet since the sire furnishes one-half of the original germ, it is not surprising that in external and general character there is retained a *fac-simile*, to a certain extent, of him.

8. The ovum of the mammalia differs from that of birds chiefly in the greater size of the yolk of the latter, because in them this body is intended to support the growth of the embryo from the time of the full formation of the egg until the period of hatching. On the other hand, in *mammalia* the placenta conveys the nourishment from the internal surface of the uterus to the embryo during the whole time which elapses between the entrance of the ovum into the uterus and its birth. This period embraces nearly the whole of the interval between conception and birth, and is called *utero-gestation*.

9. In all the mammalia there is a periodical "heat," marked by certain discharges in the female, and sometimes by other remarkable symptoms in the male (as in the *rutting* of the deer). In the former it is accompanied in all healthy subjects by the descent of an ovum or ova, into the uterus, and in both there is a strong desire for sexual intercourse, which never takes place at other times in them (with the single exception of the genus *dimana*).

10. The semen retains its fructifying power for some days, if it is contained within the walls of the uterus or vagina, but soon ceases to be fruitful if kept in any other vessel. Hence, although the latter part of the time of heat is the best for the union of the sexes, because then the ovum is ready for the contact with the semen, yet if the semen reaches the uterus first, it will still cause a fruitful impregnation because it remains there (or in fallopian tubes) uninjured until the descent of the ovum.

11. The influence of the male upon the embryo is partly dependent upon the fact that he furnishes a portion of its substance in the shape of the sperm-cell, but also in great measure upon the effect exerted upon the nervous system of the mother by him. Hence the preponderance of one or other of the parents will, in great measure, depend upon the greater or less strength of nervous system in each. No general law is known by which this can be measured, nor is any thing known of the laws which regulate the temperament, bodily or mental power, color or conformation, of the resulting offspring.

12. Acquired qualities are transmitted, whether they belong to the sire or dam, and also both bodily and mental. As bad qualities are quite as easily transmitted as good ones, if not more so, it is necessary to take care that in selecting a male to improve the stock he is free from bad points, as well as furnished with good ones. It is known by experience that the good or bad points of the progenitors of the sire or dam are almost as likely to appear again in the offspring as those of the immediate parents in whom they are dormant. Hence, in breeding, the rule is, that like produces like, or *likeness of some ancestor*.

13. The purer or less mixed the breed, the more likely it is to be transmitted unaltered to the offspring. Hence, whichever parent is of the purest blood will be generally more represented in the offspring; but as the male is usually more carefully selected and of purer blood than the female, it generally follows that he exerts more influence than she does; the reverse being the case when she is of more unmixed blood than the sire.

14. Breeding in-and-in is injurious to mankind, and has always been forbidden by the divine law, as well as by most human law-givers. On the other hand, it prevails extensively in a state of nature with all gregarious animals (such as the horse), among whom the strongest male retains his daughters and grand-daughters until deprived of his harem by younger and stronger rivals. Hence, in those of our domestic animals which are naturally gregarious it is reasonable to conclude that breeding "in-and-in" is not prejudicial, because it is in conformity with their natural instincts, if not carried farther by art than nature teaches by her example. Now, in nature we find about two consecutive crosses of the same blood is the usual extent to which it is carried, as the life of the animal is the limit; and it is a remarkable fact, that in practice a conclusion has been arrived at which exactly coincides with these natural laws. "Once in and once out" is the rule given by Mr. Smith in his work on the breeding for the turf; but twice in will be found

to be more in accordance with the practice of our most successful (early) breeders.

15. The influence of the first impregnation seems to extend to the subsequent ones; this has been proved by several experiments, and is especially marked in the equine genus. In the series of examples preserved in the museums of the College of Surgeons, the markings of the quagga, when united with the ordinary mare, are continued clearly for three generations beyond the one in which the quagga was the actual sire, and they are so clear as to leave the question settled without a doubt.

16. When some of the elements of which an individual sire is composed are in accordance with others making up those of the dam, they coalesce in such a kindred way as to make what is called "a hit." On the other hand, when they are too incongruous, the result is an animal wholly unfitted for the task he is intended to perform.

Cross-breeding.—Cross-breeding is in a limited sense the opposite of in-and-in breeding. It is the pairing of animals of *different* breeds.

Now, as we are importing largely the Percherons, Clydes, Shire, and Cleveland bay horses to cross on the mares of unknown breeding, and as farmers generally are crossing on the native cattle, sheep and swine, some of the many breeds of cattle, sheep and swine that have been imported or bred up to a high standard of excellence in this country, we can not pass this subject without discussion. And as it is for farmers who are interested in breeding of all domestic animals our illustrations and principles announced will be such as are applicable and helpful in breeding of all kinds of farm stock.

The terms, "crossing," "making a cross," "out-breeding," "cross-breeding," "grades," "breeding-in-line," are so loosely used and often erroneously, that it may be well here to define them. The terms crossing, making a cross, cross-breeding, strictly speaking, should mean pairing two of opposite breeds, such as Percheron on Clydesdale, or short-horn on Hereford. Their produce would be cross-bred animals. "Cross-bred" animals are confounded with "grades."

A **GRADE** is the produce of a pure-bred animal of a recognized type, and a “native,” or mongrel or scrub, or animal of unknown breeding, or of no established breed. A colt from a common mongrel mare by a Percheron horse is a grade Percheron or half-blood. This half-blood bred again to a pure Percheron would give a grade Percheron or a three-quarter-blood. A calf got by a shorthorn bull on a native cow is a grade shorthorn. A calf got by a shorthorn bull on a Hereford cow is a cross-bred calf.

“Breeding-in-line” is pairing animals of fixed family-traits of same breed. A Bates bull bred to a Bates cow of same line of blood is breeding-in-line. But breeding a Bates bull to a cow of the seventeen importation would be out of line, though bull and cow are both shorthorns. Pairing a trotting-bred mare of the Mambrino family with a Canuck trotting-stallion would not be considered breeding-in-line, though both animals trot. That might better be termed “crossing” or “making a cross.”

Doubtful Advantages.—THE ADVANTAGES of cross-breeding have been largely written up, and many things claimed for it are purely imaginary. Crossing a high-bred Mambrino or Hambletonian mare with a Canuck or Morgan stallion might give a more docile colt and firmness to hoof and leg, and give an element of constitution that would counteract the effeminacy that may come from too long and intimate in-and-in breeding; but the breeding of the stallion would be so much inferior to that of the mare that improvement in the lines named would hardly be expected.

The law generally accepted is, the sire should be better bred than the dam, or expressed in a general term, “bred up and never down.” In cross-breeding the common and accepted practice is to use the type of male we aim for in the offspring. If size and bone are to be increased, we choose the blocky, compact, short-jointed draft-stallions to cross on the common mares. This method prevents the error common, of making extreme or violent crosses. It is unreasonable and contrary to the experience of centuries to expect a symmetrically developed animal from an overgrown, coarse brute on a light-boned, narrow-chested mare, that lacks vigor and substance as well as breeding.

A shorthorn bull of a strain long bred for beef and not for milk, can not be expected to cross on the native cows and greatly improve both beef and milking qualities. It may do so if the bull is descended from a line that not many generations back excelled as milkers, as many of the shorthorn family once did. But such a cross will insure improved beef points, without a shadow of doubt. That is breeding up and not down. But even that kind of breeding calls for a knowledge of the ancestral lines of the bull to enable the farmer to dictate a cross that will lead him to the end he works for. A distinguished authority has said: "We are fully convinced that even for cross-breeding, the purer the blood on the paternal side, the more clearly will excellence be stamped on the progeny."

Difficulties attending Cross-breeding.—The men who resort to cross-breeding are not usually breeders of any well-established breed. There is a great and powerful tendency of any well-bred type to reassert itself, though temporarily obstructed. The great director of the Agricultural School of La Chamoise, speaks forcibly of the difficulties met in his attempt to establish a Chamois breed of sheep by using the English ram on a French ewe. Most of the lambs resembled mother more than father. A few resembled both. After many years attempting to establish a breed of sheep from English and French purebloods, he cut the Gordian knot by seeking the rams of great purity and antiquity of pure blood, and crossed them on "French ewes of mixed blood, or of no breed at all."

Mania for Out-crossing.—There is a mania for out-crosses among farmers that is not founded on large experience or science, but arises rather from the commonly accepted opinion that close breeding is dangerous. They do not recognize that indiscriminate breeding is disastrous. Out-crossing is resorted to by the inexperienced for the same reasons that lead to in-and-in breeding is practiced by breeders and improvers of pure-bred animals. George Cully lays down the following rule: "And where you can no longer, at home or abroad, find *better males* than your own, then by all means breed from them, whether horses, neat cattle, sheep, etc., for the same rule holds good

through every species of domestic animals; but upon no account attempt to breed or cross from worse than your own, for that would be acting in contradiction to common sense, experience, and that well-established rule, that “best can only get best.”

Grades better than Crosses.—Miles says, “As well-bred males can readily be procured, the greatest improvement in the mass of our farm-stock must be made by a system of judicious crossing.” The miserable failures that come from attempting to cross two well-established breeds, which produce a mongrel, and the general and marked improvements which invariably follow from breeding natives to thorough-bred horses and pure-bred bulls, boars, and rams, lead us to say: A “grade” is an improvement on the dam, and a “cross” is a disappointment. Earl Spencer says: “The worse bred the female is,” the greater the influence of a well-bred male on the offspring. As a general rule, the crossing of two animals of distinct and well-established breeds is unproductive of a better animal than either. Mr. Spooner says: “To cross for cross sake is decidedly wrong; that unless some specific purpose is sought for by crossing, it is far better to cultivate a pure breed.”

Grade or Cross-bred Sires to be Avoided.—The value of cross-bred or grade animals for breeding purposes is diminished by the tendency to reversion; a law that is ever present. The chief improvement in mixed breeding comes with the first cross of a pure blood on a female of mixed or unknown breeding, hence it is not most profitable to use cross-bred or grade animals for sires; but they being better than the mongrels or natives, are better than the latter for dams. An able writer on sheep, says: “Changes, in fact, by crossing, are not to be effected in a short space of time; you must look forward to several years of constant exertion before you can hope in this manner” to so alter your stock as to form a new breed. Cross-breeding of cattle, sheep, and swine, as a means of increasing size, and tendency to lay on fat, has been most successful when accompanied by liberal feeding.

The Cross of a Large Male on a small female has been a much discussed question. As now the use of the large draft

breeds is on the increase, it may be well to note some of the results. Mr. Dunham, the great importer of Percherons, reports that he has seen Percherons of two thousand pounds weight successfully bred to mares of nine hundred and one thousand pounds weight, and the produce was neat, large, and finer than the horse. We have noted the dangers of such violent crosses, and will not repeat here. The safer way is to cross, for the first time, the smaller, more compact, and more uniformly well made draft-stallions on the smaller native mares, and then use the produce for mating to the larger type of horses. We may thus reach the size, and avoid the ungainly developments that are so often met with in violent crosses.

Difficulties in Parturition.—As to difficulties in parturition, they seem to be more imaginary than real. The ponderous Percherons and Clydes have been bred to the little broncho mares of the plains, without harm to the mares. If the presentation is correct there is no difficulty. False presentations are always dangerous, and in all animals. The Cotswold and Lincoln sheep have been bred on common and grade merino ewes, and Prof. Miles says he has “failed to meet with a single instance of difficult labor arising from such influence.” He says: “The size of the young animal at time of birth is evidently determined by the dam, while its development after birth may be influenced by the inherited qualities of either parent.”

Uses of Cross-breeding.—The uses of cross-breeding are: First, to counteract the enfeebling tendencies of too frequent in-and-in breeding. Second, to bring together like powers or tendencies which have become noted in widely different strains of blood. Breeding trotting-stallions to pacing-mares has produced some of the fastest horses. Third, to improve inferior or scrub stock by use of pure-bred males. The use of thorough-bred stallions on common mares, or shorthorn bulls on common cows, or pure-bred bucks on the Mexican sheep of the plains, has been most useful. It must be remembered that the greatest improvement comes with the first cross of the pure-bred sire.

Agassiz has told us that “no offspring is simply the offspring of its father and mother. It is at the same time the

offspring of the grandfather and grandmother on both sides; in fact, this dependence of offspring, or liability to reproduce family characteristics, extends much further up the ancestral line." Hence, there can be no progress in the science of breeding until we have means of knowing the characteristics of families we intend to cross or to use in the breeding lots. This principle calls for herd-books and stock records, thoroughly and honestly edited. The value of pedigreed animals from families of long lines of ancestry distinguished for excellence must be enhanced as years of testimony accumulate.

The Influence of Previous Impregnation.—Professor Miles says: "The influence of the male in the process of procreation is not limited to his immediate offspring, but extends also through the female that he has impregnated to her offspring by another male." The writer has examined the views of Agassiz, Darwin, Carpenter, Law, and others, and he finds difficulties in accepting in full the principle announced and sustained by a long line of very pertinent examples. The belief is common among old and observing breeders of cattle, swine, and chickens. If further discussion of the principle or theory is desired, it can be found in the writings of any of the authorities named.

There is enough known of the theory to make the careful breeder exceedingly cautious as to the kind of a sire he allows to cross for the first time one of his pure bred females. In the chicken yards there are many examples showing the influence of first impregnation. Mr. Wright, after a large experience and extended investigation, says: "At all events, * * * we would never on any account allow any valued hens to mate with another breed." Agassiz says: "I have satisfied myself by numerous experiments that the act of fecundation is not an act limited in its effect, but is an act which affects the whole system, the sexual system especially, and in the sexual system the ovary to be impregnated hereafter is so modified by the first act that later impregnations do not efface that impression."

When such high authorities express so positively the power of first impregnation, it becomes the true student of the science

of breeding to hold his views in abeyance until he has more fully examined the subject. At a time like this, when the several breeds of horses, cattle, sheep, swine, and poultry are each gradually assuming a recognized and accepted color type, we can not afford to disregard any influences that may tend to mar the color or form, or quality of our favorite breed.

The breeder of pure bred Percherons or Cleveland bays can not afford to cross his pure bred mare with a horse of another breed of a different color. The breeder of Berkshires can not risk his best sows to be served by any but Berkshires of good color, form, and breeding. The breeder of chickens can not hope to keep a good name if he allows his light Brahmas or Plymouth Rocks to mate with cocks of unknown and impure blood.

The influence of first impregnation is far reaching, and the filly chosen for a brood-mare should be crossed only by the pure blood and best type of the breed and purpose for which she is to be used.

Soundness of Parents.—Of all principles that should be kept in mind by the breeder of horses, the first is, the *sire and dam should be free from disease*. That constitution and endurance, like weakness and disease, are inherited, no intelligent observer or student denies. Because there are exceptions to this rule does not make it safe to deviate from it. A sound horse is far more likely to get sound colts than an unsound one. Among the Arabs and the English, special stress was laid on the soundness of the mare.

Government inspection and license of stallions has been recommended as a means of improving the quality of horses. If government inspectors were all sound in judgment and morals, we might expect great good from the government inspection of horses intended to be let for service.

The method of stabling in damp, dark stables, in a vitiated atmosphere, together with excessive strains on constitution and powers of horses by exposure to storms and extremes of heat and cold, and sudden stopping in cold winds after violent and wearing work, all tend to weaken the race of horses. All artificial methods of keep and feed and work are abnormal

and against nature, and tend to undermine the stamina and hardiness of the horse. The science of breeding, together with better knowledge of sanitary laws, must help to prevent the ills incident to these dangers attending the horse in civilization. Of sanitary conditions we will speak further under hygiene and sanitary conditions.

Best Age to Breed.—The mare is capable of breeding at two years old, but as the size, good form, and sound health are essential to the value of the horse, it is unwise to risk these by so early taxing nature heavily. The old English view is a safe one, that one or the other of the parents should be mature. If a young mare is to be bred, the horse should not be less than eight or ten years old, and it is generally accepted that an aged mare, if bred at all, will do better bred to a young horse. If both horse and mare are very young or very old, the colt is generally weak and small. Many of the best horses have been gotten by old stallions. Old or worn-out mares are not successful. The history of trotters does not show a remarkably good colt from any of the noted old mares that have been retired to the harem from the track. Old mares that have been kept breeding, and not worn out by hard labor, have produced some noted horses. A good rule is to wait until the mare is past three, and then breed to a horse of full maturity.

The Farmer as a Breeder.—While we have a great number, and that number rapidly increasing, who devote their farms to the breeding of horses, still they produce but a small per cent of the horses annually reared in the United States. The farmers who keep from one to three mares produce the great bulk of the horses. Hence, the importance in this work intended for farmers of giving direct attention to the horse on the farm, and giving such principles and suggestions to farmers as will help them to not only breed horses of better blood, but to so handle, feed, and manage them as to produce the most valuable horse.

It is not possible that farmers as a class should be as well versed in the art of breeding and rearing horses as are those who have made it a specialty, but there are some bottom principles

given before, and some general instruction to be given hereafter, that may be valuable to all who raise colts. No one, be he breeder or farmer, can expect to produce valuable horses from inferior and unhealthy and unsound animals. The farmer who would raise a colt or two each year can not afford to breed from a broken-down weed or cast-off brute that is unfit for any useful work.

The Kind of Mares for the Farmer.—Let the farmer who would make colt-raising profitable see, first, that he is the owner of mares that are *sound*, and have no hereditary taint. A mare with defective wind, ring-bone, spavin, bad feet, poor eyes, and the like, will be the dam of colts with like defect. Men are deceived often because such ailments do not appear on the colts while young. But the careful observer will find that a colt from a mare with ring-bone, or corbs, or spavin, or defective eyes, will develop these disorders in the majority of cases before they are mature, even though the defects do not appear when young. Like consumption in the human family, it may not appear until the children arrive at maturity, and they are exposed to severe labor or the system is taxed by a cold and exhaustion from toil.

Inherited Defect.—When a disease is inherited it is ever ready to break forth at favorable opportunity, which comes with a cold, or depletion of the system by disease or a long-continued labor. Of one thousand cases of insanity noted in France, fifty-three per cent were hereditary. In the family of Le Compt it is said thirty-seven of his children and grandchildren became blind like himself, and the blindness came on at about the age of seventeen or eighteen years. Blindness is well known to be hereditary. Lexington was largely used as a getter of thorough-breds, notwithstanding he was blind. The breeder assumed that his colts would not go blind before they were five years old, and by that time the usefulness of the race-horse has been completed, if put to running at two. Strains of back tendons argues a weakness that ought not to be propagated. So with swelling legs, grease, chronic cough, thick wind, and so-on.

We see here the importance of knowing well not only the

mare we breed, but also the ancestral lines, that unite in her blood. She should come of a sound and honorable ancestry. Disabilities may lie dormant for years, or even generations, and then appear. Hereditary weakness of bone, hoof, sinew, and sight should not be propagated by breeding mares so affected. Weakness of the eye is a more serious malady than is generally thought. It leads to shying, flight, and often unmanageableness of horses, that make them not only unpleasant but dangerous animals.

The Color of the Mare is of more importance than is usually considered. While it is true, "a good horse can not be of a bad color," it is equally true that a good horse is the better for having a good color. As the mare and stallion are to duplicate their qualities and markings, it becomes a matter of values, of dollars and cents, that the farmer exercise reasonable care in breeding such mares as will produce the most attractive animals. We can not in breeding racers and trotters expect one in ten to be distinguished for speed. While they may all move well, their values will be greatly enhanced by good size and fashionable colors. They may then find a ready sale for coach or driving-horses. The mare, then, should not only be sound, of good family, but of good color. We may also add

The Size of the Brood-Mare is most important. The importance of a "roomy" mare is recognized by all, but that we consider a small thing compared with the other qualities named above, combined with strength of back and limb, depth of chest, and breadth of loin and hips, and quality of bone and joints. The dam that is small is not necessarily a breeder of small colts, because we note that *size* runs more in families. If the mare or horse be of a family that makes large horses, we may more confidently hope for colts of good size from mares of medium size of such family than from large mares that are exceptional in their family.

The usefulness of the mare is greatly enhanced by her size and strength, and they are inheritable traits that will add much to the value of her offspring. The farmer who will become the owner of large, handsome mares, of good style and action, of

rich bay color, with clean, black legs, and flowing tail and mane, and quality and disposition good, and will breed them to horses of equal or higher merit, will find he owns valuable property, and will do much to improve the stock of his neighborhood.

A Profitable Mare.—A gentleman in Butler County, Ohio, paid three hundred dollars for a well-bred filly at three years old. She was kind in disposition, sixteen hands high, well and strongly built, and had good trotting action. He has used her on his farm, to his carriage, and bred her to first-class stallions, paying from fifty to one hundred dollars for service, and has in six years produced five colts, and has never sold one for less than four hundred and up to one thousand and five hundred dollars. He considers her the best of property.

The kind of brood mares kept on the farm decide the kind of colts the farmer will raise. The farmers are the producers of the great mass of horses raised, and we can add to their value in no easier and quicker way than to entirely cease breeding the inferior mares, and seek to stock up the farm with only the best. *The best is the cheapest* in all kinds of breeding stock.

Relation of Size in Sire and Dam.—We have said the size of the dam is important, and would impress this fact, as there has been a neglect of the size in the mania for speed.

While the trotting-horse has come to the front, and done so much to improve the action and pluck of the produce from cold-blood mares, there has been too little attention paid to the size of the stallions and mares. Men have bred any thing that had speed, or loved to go, until we have now an over-stock of undersized horses. They have good action, are hardy, but too small for all farm work, or even to draw a buggy with two persons.

Farmers and horsemen are recognizing the mistake, and public sentiment is reacting and going to the other extreme. Farmers are breeding their small mares to the largest horses they can find, regardless of action or quality. Size, and size only, rules with the extremists. They are attempting to breed-up the size by using over-grown stallions. The experiment will surely end in disaster. The farmers of Yorkshire, England,

attempted years since to meet the demand for large horses by breeding their small mares to the great Flanders and cart-horses, and others of ponderous size. We are told their result was a dismal failure.

The Morgan horses were hardy, active, kind, and a most useful strain of horses, but after they became noted, farmers bred all sizes of mares to the nearest little Morgan, and to the most ill-proportioned, ill-dispositioned, and ill-bred little horses that happened to be faster than the average farm-horse. One extreme follows the other. And now we are on the eve of a rush for big horses. We here remind the farmer of the principles laid down in this work, and ask them to select only well-formed mares, of good size, and cross them with none but horses of excellence in more than one thing. Bigness and fat cover a multitude of worthless qualities. We need more size and bone, and action and pluck, with docility in the stallions. See that they possess these in a high degree or do not use them.

The value of the stallion is not in the answer to the question, "How much does he weigh?" but rather "*What can he do?*" "How is he bred?"

Choosing the Stallion.—Many think the influence of the stallion more important than that of the mare on the foal. Be that as it may, it has been much theorized upon; yet so long as individual excellence is not confined to either sex and may predominate in either one, we may soon be able to determine which of the two has the most influence in defining the characteristics of the foal. But as the horse in one year may beget scores of colts and the mare drop but one foal, the horse will impress his qualities, good and bad, on the greater number. Hence the importance of having the horse one of marked excellence.

As long as "every crow thinks her own young one the whitest," we may expect farmers and breeders who have a chance-good colt to think he possesses the qualities that should make a stallion. And as long as the average farmer continues to breed the cheapest foal-getter, so long we may not hope for any marked improvement in the class of stallions kept before

the public. They will continue to be a weedy, over-fed, lubberly set of brutes, whose plumpness and sleek coats will captivate the inexperienced, and the low cost of service will enable this class of stallions to beget the majority of the foals dropped. This kind of breeding, or want of breeding, degenerates the horses of the country, rather than improves them.

The wild horses of the plains in the natural selection do better than that, for the strongest and most powerful and active and plucky stallions serve the most mares. With our advantages of better feed, combined with the use of only the best stallions, we should see our stock of horses rapidly improving.

Pedigree, then Quality.—Stonehenge says: "In choosing a stallion to breed from for speed, the first thing to be considered is his pedigree." "Next to pedigree should be considered speed, bottom, health, size, style, color," and the writer adds, disposition. "In breeding for speed, it should be remembered that size is important, if the colt turns out fast, and still more, if he does not." If he is large enough for taking a carriage, with two persons, over the road at a lively gait, the breeding was not a failure.

Some Defects may be Corrected.—"If the mare has any particular defect, a horse should be chosen that will correct it in the progeny;" but the writer would warn the reader against attempts to correct such defects as thick wind, weak tendons, spavin, ring-bone, and the like. Mares that have rather light bone, or do not fill the eye as to form of neck or outline, or have a want of muscle, or the leg is a little lacking in strength or straightness—such defects we may in a measure correct by a judicious selection of the stallion.

It is said, "Every chain has a weak link," and every horse has a defect that the careful observer may detect. The defect may be one that offends the eye only, and not impair the usefulness of the animal. Such defects we may aim to correct, but let us not aim to correct constitutional and hereditary taints. We will the more likely entail such if we breed animals possessing them.

"Every part of every offspring partakes of the quality of

both parents in some degree, and in the present state of our knowledge we can neither control nor foresee the amount of any particular quality that the offspring will inherit from either parent." "If parents are alike in any particular, though different in all other respects, their offspring will all inherit that quality strongly which comes from both parents, and will transmit it to the next generation with greater certainty than if they had inherited it from only one parent."

If the trait or quality is strengthened by a line of ancestors on each side, the chances that the offspring will inherit that trait in a marked degree are increased. From this we see how little hope we may have of getting good and serviceable horses from the random crossing of ill-bred and defective animals. Let the farmers exercise greater care in the selection of the stallion for the class of mares we have commended, and the breeding of horses will advance.

The Ideal Farm Horse.—As a help in the selection of a horse for purchase or breeding, we will copy what has been written by Commissioner Loring. He says: "When I commenced farming I made up my mind that my horses should be as good as my sheep and cattle; that none of them should be surpassed, and that I should find out a way to breed and rear my own, instead of going into the market to purchase the fruits of other people's industry. I knew very well what I wanted. I did not want a running-horse, nor a saddle-horse, or a cart-horse; I wanted a horse of all work—a horse weighing a little more than a thousand pounds, in good road condition; fifteen hands and one inch high (for I had found that this height and weight usually go together); with a head not too fine, wide between the eyes, and high above them, with a good-sized, steady, erect, and lively ear; with every bony process sharp and prominent, even the processes of the first cervical vertebra behind the ears; with a calm and well-set eye, and lips which indicate determination rather than delicacy; a Websterian head, with a neck well muscled, well arched, strong and elastic, with active motion, and a throttle loose and open; with withers sharp and thin, but solid and strong; with a shoulder set loosely on, broad

and deep at the base; with a strong arm, sinewy leg, short cannon bone; firm and not too long or elastic pastern, and a firm foot; with a deep chest, without a prominent and bulging breast-bone; with a round barrel, ribbed well back to the hips, but not so far back as to interfere with the action of the hind-quarters; with a short back, and a slight elevation of the rump just behind the coupling; with a long and strong quarter, well muscled inside and outside; with a hind-leg so set on that the action shall be free and open, and with the fore-leg so set on that the toes shall not turn out, for fear of brushing the knees at speed, and that they shall not turn in too much, for fear of paddling. I wanted a good, strong bay color, with black points, and a temperament calm, collected, fearless, defiant, and brain quick to learn and strong to remember. This was the horse I wanted, and I felt sure I could breed him."

Mr. Fitch says, "Dr. Loring did breed him successfully, and so may any farmer who understands the true principles of breeding, and conforms to them."

Dr. Loring's style of a horse is a good one, but a larger horse will suit the Western farmer better, whether he wishes to use him at farm work or to sell him. A horse sixteen hands high, or sixteen hands one inch, weighing from twelve hundred to thirteen hundred pounds, is none too large for the plow or the wagon or carriage, and will bring one half more money than one fifteen hands high.

A Farmer's Team of Mares.—The farmer who secures such a team of mares as we have described by A. L. Sardy, in the *Rural New Yorker*, will have what few possess—a model farm team.

"The best team for the farmer is the one which will best answer *all* the purposes of the farm: plowing, hauling, taking the farmer and his family to town, or his boys and their sweethearts for a lively sleigh ride; and, in addition to all this, will give him a pair of colts every year, which will earn their keep from the time they are two years old until they are sold for eight hundred or one thousand dollars at five or six. The team to do this is a pair of handsome bay mares sixteen hands high,

weighing one thousand and two hundred to one thousand, two hundred and fifty pounds each, with small, bony heads; large nostrils; broad foreheads; large, bright eyes; small, tapering ears; long necks, nicely arched, deep as they spring from the shoulders and small at the throat-latch; long, oblique shoulder-blades; moderately high withers; short backs, and deep but not over-broad chests, because a horse with a very wide breast, although usually of good constitution and great strength, is seldom a graceful or rapid trotter; is apt to have a "paddling" gait, and if used for road work will generally give out in the fore-legs from the extra strain put upon them by the weight of the broad chest. Our team must also have long, muscular thighs; large knees and other joints; short cannon (shin) bones; legs broad below the knees, and hocks with the sinews clearly defined; fetlocks free from long hair; long, moderately oblique pasterns; rather small, though not contracted feet; broad loins; wide, smooth hips, and long, full tails. They must have plenty of nervous energy, and good knee action; must be prompt, free drivers, capable of trotting a mile in four minutes; be fast walkers, and good, hearty eaters; must not "interfere," and must carry their heads well up without checks when on the road.

"It will readily be seen that these mares are neither Clydesdales, Normans, Canadians, Arabians, thorough-breds, nor trotters; but they are a team which will pull the plow through two acres of land in a day; will pull a ton, yes, two, if the roads are good, of produce to the village four miles off in less than an hour, and trot back with the empty wagon in half that time without distressing themselves or their driver. Should the farmer have a trip of twenty miles to make on business or pleasure, he can hitch them to his spring wagon, take his wife and children with him, and they need not be away from home more than three hours; or should he choose to go on horseback, he can mount one of the mares and enjoy a ride on a very fair saddle-horse. A team of Clydesdales may pull a heavier load at a dead drag; Canadians will stand more exposure and poorer fare; Arabians are better saddle-horses; thorough-breds can out-

run them; trotters, when hitched to a light buggy, can pass them on the road; but neither of these breeds combines anything like the desirable qualities for a farmer that the team which I described possesses; and when it becomes desirable to dispose of their produce, the colts of such mares will find a readier sale than those of any of the others, being exactly suited to the wants of the rich city gentleman for his family carriage; for which he must have a strong, handsome, showy team, and as such teams are always scarce, he must pay a good price for them.

“Large dray-horses usually bring remunerative prices; but few men will pay as much for a team to haul their bales of cotton, or barrels of flour, as they will for a team to draw their families in Central or Lincoln Park, in winter, and at Newport, or Long Branch, in the summer, where each millionaire strives to outdo the others in the beauty and style of his carriage-horses.

“It will be useless for the farmer to try to get such horses as these for a very low price; but when he has found them, never mind the price; an extra hundred dollars or so invested in such a span will pay better interest than in the savings bank. When the farmer has obtained his team of mares, let him look for a stallion of as nearly the same type as he can find. He must be fully sixteen hands high, of good disposition, and have the bold high knee action which characterizes a fine carriage-horse, for which rich buyers are willing to pay liberally. If this horse can trot in three minutes instead of four, so much the better.”

How Size may be Increased.—The use of the enormously large sized stallions is the common way to increase size. This method is the short cut, and will do for increasing the size of the ox or hog, where bulk and weight are the prime objects. But as the horse's value is not as a meat producer, but as a working animal, we must care first for building up the frame and muscles harmoniously and symmetrically, so that every part is strong. The stallion of good proportions, bred to strong, healthy mares of like good form, each of medium size, will give

produce of greater strength, and vigor, and endurance, than that from longer-jointed, longer-backed animals of quicker maturity and growth.

The Stallion.—From what has been said of the mare and stallion we see that there is far more to consider than mere size and plumpness in the sire. All men, even the best judges, are likely to be deceived by the liberal feeding and careful grooming which the stallions of the country receive. They are kept in so much better condition than the working animals of the farm, that the contrast between them and the laboring horse is like that shown between the city society-man and the farmer enured to daily toil. The former is fitted out for display, and the latter for business. The vigor of the latter excels that of the former as much as does the style and dress of the exquisite excel the plain, much-worn garb of the toiler. Let us not be deceived by what good grooming can do for the man or the horse. A few months of hard work will take the shine all off, and leave only the frame-work and the hardened muscle. If these are uniformly strong and in good proportion, and the animal comes of a family of good breeding, whose ancestors had merit, and a noble spirit and good disposition, the chances are strongly in favor that the produce of such an animal will inherit so much of the virtue of the sire and his family, as that the foal will be of value.

Feminine looking Male.—There is no surer mark of effeminacy in man or horse than to see one with the delicate bone and head, and light, neat muscle of the female. In selecting the male we are not looking for one with female characteristics. The stallion, the bull, and the boar should be masculine in every marking and fiber. His distinguishing beauty should be the proud spirit and fire, and courage and force of the male. Power and resoluteness should mark him at every point. The sires that have made their impress on their posterity have not been those of the smallest head and muzzle, the delicate and graceful neck, and the best rounded form. Their form and nature were too strong and marked with power to be always smooth and neat at all points.

The best judges know how to weigh the value of strength against the delicately rounded outline. The mare may not be coarse at any point, but the strongly marked powers of the male may manifest themselves in the large, bony, clean, brainy head. The muscle and flesh of the mare will be more rounded and graceful in the outlines, and the head, neck, and limbs be more neat and more gracefully moulded. Her form will tell more of quickness and fleetness, while her male-mate will manifest more courageous strength and force in his step and action. Neither will lack the ambition to use the hidden power.

The Influence of Sire and Dam.—Abdel Kader in a letter to General Daumas discusses this subject. He does not endorse the commonly accepted view, that the Arab prizes the mare more than the horse, because she gave character and quality to the foal. He attributes great influence to each, if well bred. He says it is true the foal proceeds from the sire and the dam, but the experience of ages has proved that the essential parts of the body, such as the bones, the tendons, the nerves, and the veins, proceed always from the sire. This is beyond all doubt. The meanest Arab knows that any malady, especially belonging to the bones, under which the sire may be suffering at the time of covering, will be perpetuated in his produce, such as splints, bone and blood spavins, the shape of the bones, and all diseases of the vertebral column.

The dam may give to her produce color and a certain amount of resemblance in form, the foal naturally partaking of some of the qualities of the animal which had so long borne it; but it is an incontestable fact that it is the sire who gives strength to the bones, substance to the tendons, vigor to the nerves, rapidity of pace; in short, all the principal qualities. He also communicates what may be considered moral qualities, and if he be unquestionably of high blood, the foal is preserved from vice. "A horse of noble race has no vices."

"The foal follows the sire," is an old Arab maxim which Abdel Kader fully endorses. Because of this universal belief the Arab is difficult to please in the selection of a stud-horse, and if he can not find one to please him of pure blood, he will

leave his mares unproductive. To procure the service of a good sire they do not hesitate to travel any distance. "An Arab will lend his stud-horse gratuitously; he never accepts payment for his services. It is considered an unworthy action, but it is an act of generosity he will not readily bestow on any one, nor for any mare."

W. C. Spooner, a high English authority on such matters, says: "The influence of the male and female is not capricious, but yet not always alike; in the majority of instances the male gives the size and external shape of the offspring, particularly the back and hind-quarters, while the female influences the constitutional, the nervous system, and often the head and fore-quarters. * * * It is such a fusion of two bodies into one that both defects and high qualifications are passed from parent to offspring with a sort of irregularity resembling the waves of the sea, each parent having the remarkable power of propagating ancestral peculiarities, though latent in itself."

Another English writer says: "Instances have come under the notice of the writer where a tribe of horses have bred in one family for many generations, the males of which inherited the bad habit of kicking in the yoke; and although crossed with very docile sires, the same propensity and nervous temperament was transmitted from one generation to another. Others, again, preserve the unwelcome and annoying habit of being shy pullers; and others, again, when mares are hot tempered, tearing workers, but deficient in stamina or staying power. Owners sometimes breed from a mare that is hot tempered, or a kicker, to sober her down a bit. They invariably succeed in perpetuating a breed which should be allowed to become extinct."

Importance of a Quiet, Sound Mare.—The same writer says: "The importance, therefore, of selecting a quiet dispositioned mare of sound constitution, for breeding purposes, is apparent. By sober-tempered is not meant a sluggish animal; activity being very essential in a brood-mare, especially in her walk, as this is the most important pace for farm-work. It is also necessary that a farm-horse should be able to acquit itself well in a trot, and the words of an enthusiastic Scotchman,

when once describing a brood-mare, can be repeated, when he said: 'Her very step had music in it.'

Rev. "Adirondack" Murray, who has attained some notoriety as preacher and writer and breeder of horses, concludes that there is not enough of truth in the Arab maxim to make it a law. Even a casual inspection of his own stables does not strengthen the belief in the saying, "The foal follows the sire." He has "dams whose foals invariably resemble the sire in shape, size, color, style of going, and even in temperament, and these mares are prized by me as almost beyond price, because of this peculiarity. I know beforehand what I shall get. On the other hand, I have two other mares whose colts invariably resemble themselves, or some one of their paternal ancestors."

Temperament Important.—Mr. Murray infers from his observations that "The animal with the strongest vitality marks the foal." "If the dam be most highly organized, then the foal will resemble the dam; if the sire, then the foal will resemble the sire. This is the law in the human family: If the mother be of nervous, sanguine temperament, and the father lymphatic and sluggish, the child will take after the mother," and *vice versa*. On this theory the cold-blood mare bred to the thoroughbred horse should drop a foal resembling the horse, but the foals are so unlike the sires in many cases that we can not proclaim a law. Yet, in all the varying products of such breeding we find the old rule of having the male better bred than the female is true, and worthy of close following. It is by this law we have been able to improve all kinds of domestic animals. The sires, as a rule, have been better bred than the mares, which have come to them, and the improvement of the progeny as a class has been marked in the same degree as the breeding and quality of the sire has exceeded that of the dams.

Mr. Murray formulates this law, "That the best horse is he who, being good in himself, most surely and closely reproduces himself in the offspring, and to this should be added the words, when bred to the mares of the greatest variety of form and temperament."

The lessons of the past may lead us to say, with equal cor-

rectness, in a general way, *the best brood mare is the one that, being sound and of good disposition, breeds most like the horse.* The writer owns a mare that breeds like the horse in form and action, except that she usually has colts with backs and fore-quarters like herself. Whether the farmer knows how his mare breeds or not, there exists the same reason for selecting a thoroughly sound and well formed horse of the best possible breeding.

Condition at Breeding Time.—There has been much disappointment in breeding to horses that have been campaigned from year to year, and have made noted records for speed and staying powers. While these horses have proven themselves to possess the qualities that the breeders of fast and good horses would reproduce, it is an unquestionable fact that such stallions rarely have produced colts which have equalled the sires. Their frequent failures to produce valuable foals have led the superficial observers to assert "there is no value in blood," and that "hits are merest chance."

They fail to consider that any law of nature may, by counter influences, be diverted. We need not philosophize long on the cause of this disappointment. The fact that old mares and noted mares which have been hammered on the track campaign after campaign, have uniformly failed to breed foals equal to themselves or the sires of their foals may give a clew. It is accepted as true that after mares have passed their prime, and have lost vigor by reason of age and hard usage, their colts are not equal to those brought forth when the mare is in her prime, or when young.

A writer in *Wallace's Monthly* elaborated the subject of breeding old campaign stallions, and showed by reference to the records of the long line of winners of distinguished breeding and performance on the track, and which have been retired to the stud that *not one of them* has met the expectations of the owners or patrons. He treats the subject physiologically, and shows that the long courses of feeding and training of campaign horses hardens the tissues, and extraordinary development of one faculty or power tends to weaken the rest. The feed and training of the race-horse, together with the intense and long

continued tax on the vitality of the racer and trotter, have weakened the generative powers, while it has hardened the tissues and developed speed and lung-power.

The foals of such noted mares as Flora Temple and Goldsmith Maid and Lady Thorne have not shown the power and speed of their dams, although they were bred to stallions noted for their family power of producing trotters of rare ability. The expenditure of nervous power, in their long and exhaustive campaigns, has used up that vigor, or superabundant nervous power which, had it been reserved for their foals, would have enabled them to impress their excellence on their offspring. The large majority of mares and stallions which have long been in training and use on the track until past the prime of life have failed of usefulness in the stud.

The list of noted brood-mares does not include the great campaigners. The long list of successful sires does not include the old campaigners of greatest note. Rysdyk's Hambletonian, Mambrino Chief, and any of their families, who have excelled in the stud, had short work on the race-track. Their nervous force and vigor were left unimpaired and reserved for the stud, where they were enabled to impress their get with so much of their trotting instinct and power.

These facts are simply in harmony with the general law, "like produces like." The old campaigners had reduced their nervous force and vigor down below the normal level of their family, and their get had not that vigor and power that lifted them above the average. The facts are important for the breeder to keep in mind.

Condition of Sire and Dam.—Another inference comes along with them, and that is, *condition of the dam and sire at the time of mating* is important. So important is it, we see that it even so countervails all expectance of highest good from a royal record and royal ancestors, as to lead to disappointment. This matter of condition at breeding time, then, is of first importance. The sire should be in such a condition as to be able to impress his qualities on his get. The dam should be in such a perfectly healthy condition and free from nervous derangement or exhaus-

tion, and have her system toned up to the best condition of health and vigor, that her foal may be like her in these qualities.

At Conception.—The records of physiology show that the mental and physical condition of the father or mother at time of conception have fixed the character of children. The mother worn out by care and want, worry and work, has not as a rule borne the vigorous, healthy, and happy offspring. The stallion and the mare should be conditioned by moderate exercise and appropriate feed, so that at the time of mating each shall be in the best condition of health and vigor, and the nervous powers in a normal, healthy state.

After Conception.—After the conception, the use of the mare should be such as to keep her in perfect health, and her food should be of such quality and quantity as to best nourish her and the growing foetus. Of course, this would preclude any harsh treatment, any severe labor and conditions that would suddenly tax her strength. It does not, however, argue that the mare should be kept in idleness, and tenderly coddled in a box stall or small lot, where she can only sleep and eat and drink. This mode of life does not keep the highest degree of vigor and strength. "Use strengthens and disuse weakens," is the old physiological law. But it has its limitations. Excessive and long continued exertion may over-tax and weaken the muscular and nervous system. Hence moderate and regular work strengthens man or beast, and they alike are the stronger, healthier, and less nervous for regular moderate labor.

The Mare and Stallion Should Be Worked.—Within the limits of the rules given above, we claim that the dam and sire are better for moderate regular work, and the foal will be more healthy and uniformly developed because of the superior condition of the parents. The successful breeders of swine and sheep recognize the importance of keeping up the vigor of the females of their flock, if they would have strong, healthy pigs or lambs. The neglect of this practice of securing highest vigor and health by exercise of the dams while carrying their young, has caused a vast amount of loss, which is wholly unnecessary. As the value of the horse depends so

largely on his vigor and temperament, this question of working the sire and dam is of great importance.

A Matter of Economy.—On a preceding page, we have shown that it is more healthful to have the stallions labor enough to pay for their keep during the larger part of the year. It is clearly more economical. While the stallion is not in the season of service, he will be able to do much labor, and by it his muscles and tissues and nervous system be toned up to healthful action. Inaction is not according to nature of the horse. His nature demands activity and freedom to exert his mighty powers. Though while in a civilized condition it is necessary to keep him under restraint, it does not in any way argue idleness and luxury that beget effeminacy. The horse needs the exercise out of doors, to give tone to his system, quicken his action, strengthen his muscles and frame, and calm his temperament, by relieving it from the strain on his nervous system which comes from long confinement of any animal that has ability to move freely in a state of nature. If our reasoning is correct, that the condition of the parents at time of coupling has an influence on the offspring, it follows that the good of the foal also demands that the sire and dam shall be made strong to labor, and show by habitual obedience to the word of the master that there is worth and virtue in a gentle nature.

Mischief Comes With Idleness.—The disposition of stallions and mares that are well broken to regular work is notoriously far better than that of those kept in confinement and idleness. Watts said, "Satan finds mischief for idle hands to do." I am sure his Satanic majesty or some other influence finds mischief for idle studs to do. The stalls and halters that confine the unused stallions have to be of triple strength and often renewed. The pent-up energy of the high-bred horse, highly fed on oats, is something near as difficult to restrain as the steam from the boiler, under which there is a strong fire of good, sound fuel. It must be utilized, or there is danger in its expenditure of force.

Care of Stallions.—J. E. Russell, secretary of the Massachusetts Board of Agriculture, is excellent authority on all that pertains to the care and management of horses. He says:

“When a horse begins a stud career, his owner should absolutely withdraw him from the worry and excitement of training. Horses kept for service and trained at the same time will get nervous and excitable stock. But a worse error still is to put a horse into a condition of flesh, like a prize pig, in order to brag of how much he weighs and to keep him, without exercise, in the close confinement of a box-stall, until he becomes moody, morose, and often a savage brute. Many stallions become partially insane under the common treatment, and are a pest to their owners, dangerous to their grooms, and beget vicious stock. A stallion should be kept in good health and moderate flesh. His box should be where he can have the company of other horses or in sight of his mares. He should have a paddock to run in, or have plenty of cut grass during his season. He should be exercised in double harness or under the saddle, accompanied by other horses, as often as convenient. His exercise should be brisk and blood-stirring, with occasional sharp work, so as to get a good sweat. Under such treatment, a stallion, unless he is naturally a vicious brute, will be as cheerful and pleasant to keep as any mare is.”

The same principles of handling will demand that draft-stallions be put to gentle work with other horses, when not in the service of the stud.

The Two Methods.—The contrast between the French and American systems of handling stallions is great. The French stallion is taught to labor at two years old. From that on, his labor is sufficient to pay for his keep. He becomes gentle, kind and as safe to work as a gelding. He does not become frantic at the sight of a gelding or mare, or vicious and furious in the presence of another stallion, as do our unworked and over-fed stallions.

Before old Louis Napoleon left France, when a three-year-old, he was driven by a lady in her carriage. His gentleness and docility combined in such wonderful harmony with his powerful action and proud spirit captivated Mr. Charles Fellington, as he rode behind him in a heavy French vehicle at a slashing gait. The colts, stallions, and mares, are handled “by women

and children, while the men are in the fields," says a French writer. In the kind handling of colts and stallions, the same writer adds, "lies the secret of good training and the art of uniting in the horse a cool and calm temper with a decided character. He (the farmer) is laborious, and loves to stir the soil; hence his practice of early-working the colts, which renders them laborious and honest. He only requires of them work in proportion to their strength, and gives them good nourishment."

Care of Breeding Mares.—Among farmers there are two extremes. One class work their brood-mares as they do their mules or geldings, and expect them to fill the place in the team until nature calls a halt, and the foal must be cared for; and in a week's time after the foal has been dropped the mare is put into the team on the road, or in the furrow, and must do the work of her mate and the additional duty of furnishing milk for the colt that follows her. This double tax on the mare, at a time when she is reduced from the supreme labor of maternity, must work ill to dam and colt, thus entailing double loss for the cruel and heartless attempt to make double gains by overtaxing the powers of the mare.

Effeminacy comes with Idleness.—The other extreme is that of keeping mares in idleness, confinement in heated stables, and feeding with grain, and withholding exercise, sunlight, fresh air, and the grass which nature has provided as the great corrective of the system of animals that are to produce young and give milk. In this case we have effeminacy and want of vigor in dam and foal. It is important that the mare be kept up to the highest condition of vigor and strength by judicious exercise and feeding. These must be given regularly. Extreme of all kinds must be avoided. Rapid work and sudden shocks, by pulling heavy loads over rough roads, are hazardous.

Feed and Care Important.—The feed should be liberal and of good quality. The mare in foal or suckling a colt is eating to support two lives, not one, and she can not supply food convenient and sufficient for her growing colt unless she is fed liberally of milk and force-producing grains and grasses. Heat-

ing food in great quantities does not furnish strength or milk. In the winter she should have warm, well ventilated quarters, free from the vitiated atmosphere that poisons life spent in damp, badly kept stables.

From forty-four to fifty-six weeks the mare may carry her foal, and in all this time the system is gradually preparing for the supreme effort of her life, in producing another of her kind. The intelligent man should see that her condition is made comfortable and her food wholesome and abundant. The mare in foal loves quiet and freedom from the annoyance of other horses. When her time is near—say two to four weeks before foaling—she should be placed in a box-stall, or, if the weather be pleasant, in a paddock with grass, where she can have quiet and move about at will.

How to Know a Mare is in Foal.—If the mare refuse to take the horse a second or third time, we usually conclude she is in foal. If she be tried on the eighth or ninth day after dropping her foal, she will usually take the horse, and not need another service. If on the twenty-first day she decline to take the horse, the conclusion is, generally, that she is in foal.

But we may notice her appearance, and know from this: If she be “not in foal, the lips of the vagina will be moist, bright, and of a florid appearance,” says the *Complete Stock Doctor*, “and with a fresh drop of fluid at the lower part, which, being touched, will incline to extend. If she be gravid (in foal), the surface of the vagina will be dry and of a dirty brown or rusty color, while the drop that was before clear fluid will now be dark and brown. After the third month, the belly will begin to swell, and at the end of the fifth or sixth month the movements of the foetus may be seen by watching; or by standing the mare at rest and pressing up sharply in the flank, with the thumb and fore-finger closed, the foetus may be distinctly felt by the rebound.”

The Period of Gestation.—The average period for the mare to carry her foal is forty-four weeks, or eleven months. We have known this period to extend frequently to fifty weeks.

Youatt states that it may extend from thirty-nine weeks to fifty weeks. Thus we have as many weeks variation in time as there are months in the average period, or about eleven weeks. A French observer in the royal stables of France observed five hundred and eighty-two mares, and records the longest period four hundred and nineteen days, and the shortest two hundred and eighty-seven days, with an average of three hundred and thirty days. M. Gayot observed twenty-five mares, and found the average three hundred and forty-three days. The longest period was three hundred and sixty-seven days, and the shortest three hundred and twenty-four days. As a rule, small mares carry a shorter time than large ones. There is a common belief, but not confirmed by scientific observation, that the mare carries a horse colt longer than one of the female sex.

How to Know Foaling Time.—Many trust to the increasing size of the udder, but as this begins to fill and enlarge from one to three months before the colt is born, it is not definite enough. There will be no foal dropped, however, if the mare be in a normal healthy condition, until the enlargement of the pelvis begins, which is shown by the sinking on each side of the spinal column, near the tail. This occurs within three weeks of foaling time. Nature seems to be absorbing unnecessary fat or tissue from this region, and relaxing the structure and enlarging the region of the pelvis, preparatory to the exit of the foal. The sinking on each side of the spinal extension continues from day to day, as the time approaches. But this is not sufficiently definite. It is, however, a sure sign that the time is not far off, and the careful husbandman will not now tax the strength of the mare by heavy or rapid work, nor take her far her from box-stall or paddock. Her nights should now be spent in a box-stall, with a good bedding of short straw a foot deep, and with no cracks or openings where the mare or the colt could become entangled or caught. The sinking of the haunches is the timely warning. Now let the farmer notice closely the udder, and when it fills, and there appears on the points of the teats a little gummy substance, the colt will follow in one, or at farthest, two days.

Treatment at Foaling Time.—The mare, left to herself in a roomy, well-littered box-stall, will do better than to have attendance in sight, except in rare cases of false presentation, when assistance may be necessary to change the position of foal, or even to use mechanical assistance. But these cases need experienced attention, and details for such exceptional cases must be sought in veterinary works.

The stall of the mare and foal should be free from chilling winds or drafts, as nature has been heavily taxed, and the exhausted system of the mare is not in condition to resist cold and chills, as when in full vigor. The Arab's care of the newly-born colt is suggestive. So attentive are they that they do not allow the colt to touch the ground before they begin to rub dry, and follow with rubbing joints and muscles, until they have moved every joint and produced a free and active circulation in every part of the form and muscle. The colt is then held up to the dam to suck, and from that time onward is the pet of the family and the playmate of the children, as is the dog on the farms of America. The mare is put to no hard work until the foal is able to do without her milk.

Oftentimes the foal is too weak to stand up. In such case the foal should be wiped dry and well rubbed, and kept out of drafts or chilling winds. Warmth is essential now. As soon as it is rubbed dry, and the limbs have been rubbed well, to induce active circulation, hold it up to the udder, and let it be strengthened by nature's supply of milk. If left to get chilled and nature taxed, and left unattended or unfed, it is as likely to die as live. In order to have the colt become strong and vigorous and well developed, it must be well fed from the start, and it should never go back for want of food suited to its condition.

After Foaling.—As a rule, the mare should do no work for a month after foaling, but the farmer's necessities in the spring-time for every plow-animal lead him to put the mare at work sooner. This is attended with great risk. There is special danger of fever if the system is taxed and heated and chilled, as too often follow when the mare is put to plowing in the chilling winds of springtime. It is not only a severe and cruel tax

on a noble animal, but reduces her power to furnish milk to her foal, and the milk is neither so healthful nor abundant as it would have been if the mare had rested one month. The full flow of milk does not come until the dam has wholly recovered from the labor of giving birth to her young.

Too many of our colts raised on the farm are stunted at the start by too early working the mare. The strength of mare and foal are over-taxed, and the supply of milk reduced and injured in quality, while the labor of following the dam, day in and day out, in the field or after the wagon, makes a demand for more and better milk. The practice of working mares up to and soon after foaling-time has reduced many a fine colt to the rank and form of a scrub at one year old. A colt stunted before that age never recovers from it. The farmer who has a good mare and breeds her to a good horse, and pays from twenty to fifty or one hundred dollars service money, can not afford to sink the chance of his colt's growth and development for a few days' work of the mare when she is weak.

The object of breeding the mare is a good colt. The time and money spent to secure it must not now be sacrificed by unwise use of the dam. A reasonable care now that the dam and foal are properly fed and nourished, will save loss and insure gain. The colt must be fed at the udder of the dam, and she must be fed generously at the hand of the owner, to keep up her strength and a full supply of wholesome milk for the colt. Once overheating of the mare deranges milk secretions, and we soon see the colt showing the effects in his dullness or staring coat, or diarrhœa.

Care and Feeding of Colts.—Farmers busy with their growing and ripened crops, from May to December, are apt to turn the mares and colts off to shift for themselves. Many mares fail to give enough milk to properly nourish the foal, and it becomes stunted and makes an inferior animal, undersized for any useful purpose, and it is a scrub of little value. This may be avoided generally by liberal feed of the dam and early teaching the foal to eat with the dam. If the box or trough in which the mare is fed be on the ground, or set so low as that the colt

can eat with her, it will soon learn to share the oats and bran with its dam, and there is no better feed for each. It furnishes, with grass, the elements for milk, for bones and fibre, far better than corn or food richer in starch.

If the dam is a very poor suckler, as many mares are, the colt will soon learn to drink cow's milk, which will be the best feed for it. Skim-milk may be given, but it should be supplemented with flax-seed jelly or scalded oil-cake meal. A table-spoonful night and morning of the meal will be enough to begin with. It may be increased gradually, until by the time a colt is six months old it will be the better for a pint of meal with its milk and grass. The large breeds of colts will need more, and will bear two pints a day. A better plan, however, is to teach them to eat with the dam also, and furnish the colts bruised oats and bran in addition. Oats and wheat-bran supply the elements for forming bone and fibre, and keep the bowels in good condition. At this age the colt will, on such feed, make strong growth of bone and muscle rather than fat.

The true idea of raising colts is not to see how little they can live on, but how much healthful growth they can be made to make for the food consumed. All young animals will pay more for the food consumed than the older ones, if growth and uniform development and not fattening is the object.

Abortion.—After three months and up to the fifth month, abortion, if it occur, is more likely than at any other time during gestation. As a prevention the mare should not be excited by foul smells, nor the sight of blood or dying animals, nor frightened so as to greatly excite the nervous system.

During this period her feed should be increased to meet the increased demands made by the growing foetus, and its growth is now rapid. This precaution of increased feed not only prevents a weakening of the mare, which of itself is a provoking cause, but it keeps up her vigor and strengthens the coming foal. "Good feeding and moderate exercise at this time will be the best preventive of mishaps," says Youatt. He also says: "Mares that have once aborted should never be allowed with other mares, between the fourth and fifth months."

He asserts that "such is the power of imagination and sympathy" with mares, that if one aborts others in same pasture are likely to follow. Fresh air, moderate exercise, and freedom from excessive work or strains are among the preventives.

The mare which once aborts is likely to do so again about the same time in her gestation, unless it has been brought on by acute disease, or she has been cast in stall or strained. A predisposition once established, the usefulness of the mare for a breeder is about ended.

Age to Breed.—THE HEIFER.—The female, as a general rule may be bred at an earlier age than the male. Heifers are kept for milk, and the earlier the milking habit is developed the more marked it will become. If the udder be distended before the full development of the animal, the organs of secretion of milk are more pliable and distend more readily. As the milking trait gives chief value to the family cow, she should not only be bred early, but at such a time that when the calf comes the weather and feed available will be favorable to the largest development of milk. Hence, heifers bred from July to September come fresh when they may have the benefit of a long season at grass when the grasses are tender, rich, and abundant. The mild weather, too, does not call for so large an appropriation of food consumed to keep up heat in the system.

The favoring conditions of feed and weather lead to the largest possible secretion of milk, and the pliant, elastic condition of the milk glands favor the highest development of the powers of secretion. But the tax on the system, it is urged by some, tends to check growth, and the animal will never attain to as great size. If *beef* be the first consideration, then the time of first service may well be deferred until the frame and form are farther developed. Yet it is at the expense of the development of udder, and milk glands, and habit of full and large secretion of milk.

If the young heifer be liberally fed, the size will not be so much less, as the yield of milk is the greater. The care and feed go farther towards giving good size and early and best development, than the time of first service. The heifer that has

been well kept from calf to heifer is large enough and old enough to be served at eighteen months. Some of the best cows we have ever known were bred at fifteen months of age. But the danger of check in growth is largely obviated by the generous and rich feed always at hand, when the greatest strain is made on the system.

As the male is to be valued for quality, size and vigor, these must be conserved and fostered until the size and strength and highest vigor are attained. Hence, the male can not be put to service so young as the female. This general principle applies to all males.

The Sow.—The sow intended for a breeder will for the same reasons given above prove a better suckler and a surer breeder than if not bred until her size and form have matured. But, in breeding swine, we have first of all things, in the West especially, to look to the vigor and health of progeny. When the animal is a glutton, and the supply of food abundant, and too rich in starch and oil, as is our chief feed, corn, we may well have a great care that we do not put sows to breeding until their systems are well developed. Sows farrowed in March or April may safely be bred to farrow their first litter the next April or May. Sows farrowed in the fall should not farrow until the second spring. By this arrangement they have the necessary maturity and strength, and the pigs come at a season when the weather is mild, and grass is of best quality and abundant. The pigs attain good size and strength before the flies and heat will begin to annoy and tax their strength.

The Mare.—The time to breed the mare is somewhat governed by the same principles above enumerated. The horse is bred for *force* rather than *flesh*, or *milk*; hence, the first thought should be to ensure the highest possible conservation of vigor and health consistent with economy.

The mare at three years old, if properly fed, is large enough and strong enough to endure the tax of maternity. Yet her muscles, tendons, and bones are not so firmly fixed as to endure hard labor without injury. She can be handled and gentled by moderate use only, at this age. Enough of such use may be

given for needed exercise, and yet not to tax, but rather strengthen and develop her powers.

Like the heifer, her ability to give milk to her young, and to give birth to it with least tax, are important factors in making up her value. The three-year-old mare can safely be bred to foal in the spring of her fourth year. Her form and size and strength will not be injured thereby, but her usefulness as a brood-mare will be greatly enhanced. She can produce a colt of high vigor and power, and at a period of life when she could not properly be taxed to do full labor. Economy, then, shows that the mare can well be put to breeding at three years. Her strength is not over-taxed, her usefulness not diminished, and her distended form, after the foal has been dropped, will resume her normal shape more quickly than if not distended until all the frame and muscles have been fixed and set, and growth has ceased. It is a generally accepted truth that the foal of a young mare is of more value than of one that is old or on the decline.

Aged Brood-mares.—Mares usually breed quite regularly until they are sixteen or eighteen years old. There are many cases on record of their breeding well until twenty-five years. The *U. S. Veterinary Journal* gives a case where the mare is estimated to be between thirty-seven and forty years old, and has a yearling by her side, and she is heavy in foal. She never was known to be sick; her teeth are sound, and she eats well. She is of racing blood, sorrel in color, and has white points. She was owned by William Rogers, who now has six of her colts on his farm, ranging in age from one to twelve years.

Sex—Can it be Controlled?—From earliest times, the question of controlling the sex of coming offspring has been a study, and there have always been those who claimed it was a matter subject to control of the skillful breeder.

But as yet, no physiologist has been so skillful as to find at what period in its history the ovum, from the time it left the ovaries of the mother, met the spermatozoa of the father, on down to the birth, nor has been able to note the influence which gave the character of male or female to the offspring.

It is one of the many mysteries of generation, which has wisely been concealed from man.

It was at earliest date assumed that the male had two testicles, and the female two ovaries, and that somehow the two sexes had a relation to these dual organisms. It was next assumed that the right testicle and the right ovary were the producers of males, and the female came from the left testicle and left ovary. Physiologists and farmers long since proved the folly of these assumptions. Men and lower animals having but one testicle, and women and female animals with but one ovary have produced young of both sexes, and with the same regularity, as to sex, as when possessed of both organisms complete.

The *Country Gentleman*, some years ago, published the theory of Professor Thury, of Geneva, claiming that "the sex depends upon the degree of maturity of the egg at the moment of fecundation," the less mature producing a female; the more mature, a male.

In accordance with this theory, the belief is common among breeders that a female animal, served by the male during the first half of the period of heat, would give a female or a majority of females; and served later in the heat, would produce a male, or a majority of males. This has been proven a failure, after a long line of years of close observation.

There is an important physiological fact overlooked in this theory. It is this: Fecundation is the result of the ovum of the female coming into contact with the spermatazoa of the male. Now, as this union or contact does not necessarily occur at time of copulation, the theory must fail as often as this union fails. Dalton's Physiology has shown that the period when the ovum escapes from the ovary is uncertain. Caste has shown that it may escape early or late in the period of heat. In experiments with dogs and rabbits, it is shown that several days may elapse after copulation before the ovum comes in contact with the spermatazoa, if at all.

Naturalists are now investigating the plausible theory that sex is determined by the activity of the processes of nutrition.

Mrs. Mary Treat, in her study of insects, has shown, of butterflies, that, "if the larvæ be not well fed before going into the chrysalis state, the perfect insects developed from them are males; but if the larvæ are abundantly fed, the perfect insects are females."

Dzinerzon, in his study of bees, has shown that the females come from the eggs of the queen which have been fertilized by impregnation, and the unimpregnated eggs produce males. The bee men understand that if a swarm lose its queen, a new queen can be produced from working-larvæ, provided their cells be enlarged, and the larvæ therein be supplied with appropriate food. Incredible as this may seem, it is so well established that even Baron Berlepsch says, "it is nevertheless true." Mr. Knight has shown, in regard to some plants, that he can regulate the production of male or female blossoms by regulating the heat and light. "If heat be, comparatively with the quantity of light which the plant receives, excessive, then male flowers only appear." From such and similar facts, Miles says, "It may be that the determination of sex depends upon a number of conditions that are all intimately connected with the function of nutrition."

The Stuyvesant theory, which has been so widely published, is based on two assumptions, and only assumptions. The first is, "The sex of the offspring depends entirely upon the female;" and the second is, "Every alternate egg is of the same sex." If the last colt or calf was a female, and a male was desired next time, then the dam must be served by the male the first time she comes in heat. If she fails to conceive then, she must go again the third heat, or fifth, and so on. The long line of experiments on this theory have not established it. The condition of the female at time of service seems to be an important feature, not only in the matter of producing the best animal, but, if the theory of nutrition affecting the ovum have force, then the breeder may well pursue his studies further along that line, and note carefully the results.

It is held by many that young heifers and young mares bred to vigorous males drop a larger per cent of males. On the

other hand, older cows in their full vigor have produced a larger per cent of females. The facts collected at the Agricultural College at Grignon and at the Agricultural Institute of Hohenheim point that way. Flüet says, "If you put a cow that has recently calved, while still rather feeble, to a vigorous bull, the product will almost invariably be a male."

To breeders of high-bred animals, the solution of this yet unsolved problem is one of vast importance. If we could control the sex with any degree of surety or safety, we could realize greater profits from our ability to meet the demands of trade. Among Jersey cattle, for example, we should desire only enough males to keep up the stock, and would have heifer calves, whose average value will ever be more than ten-fold that of the average bull calf. Owners of breeding establishments usually prefer the foal to be a female, especially if production of a favorite family be desired. It is certain that, as yet, science has no solution of this question, about which many superficial observers have claimed to have a certain rule by which they can control the sex of coming colts.

Importance of First Impregnation.—The influence of the male upon the female is so marked and far-reaching that we may profitably consider the importance of the first impregnation. This influence is not limited to the offspring of the first sire, but to the young begotten by sires years afterwards on the same female. This paradoxical statement is supported by so many unequivocal cases of mares, cows, ewes, and sows that its discussion must be of value to all breeders of good stock.

We can not take the space to cite a fraction of the many recorded instances in proof. In 1815, a seven-eighths Arabian mare, chestnut, belonging to Earl of Morton, was covered by a quagga, a species of zebra. The foal resembled the sire in color and markings. The same seven-eighths Arabian mare was afterwards twice bred to a black Arabian stallion owned by Sir Gore Ousley. The two colts by the black Arabian "were partially dun colored and were striped on the legs more plainly than the real hybrid or even than the quagga," says Darwin. The same distinguished authority adds: "One of the colts had its neck and

some other parts of its body plainly marked with stripes. Stripes on the body, not to mention those on the legs, are extremely rare with horses of all kinds in Europe, and are almost unknown in the case of Arabians." But the case is made more striking by the fact that the hair of mane on these colts was short, stiff, and upright, like that of the quagga. Darwin says "there can be no doubt that the quagga affected the character of the offspring subsequently begot by the black Arabian horse."

A mare once bred to a jack and afterwards bred to a horse is believed to be so influenced by the impregnation from the jack as to affect the character of future colts of hers gotten by stallions. Dr. Burgess, of Denham, Mass., says: "From a mare which had once been served by a jack, I have seen a colt so long-eared, sharp-backed, and rat-tailed that I stopped a second time to see if it were not a mule." "Alexander Morrison, of Bognie," says Miles, "had a fine Clydesdale mare, which in 1843 was served by a Spanish ass and produced a mule. She afterwards had a colt by a horse which bore a marked likeness to a mule; seen at a distance, every one set it down at once as a mule." Many more similar cases can be cited to show that the impression made on the mare is not confined to the first foal, but affects future foals.

The lesson is clear. The owner of a high-bred mare can not afford to endanger her usefulness in the stud by allowing her ever to go to an inferior horse or jack. The veterinary surgeon to her majesty states that several mares in the royal stud at Hampton Court had foals in one year by Acteon, but which had the markings of Colonel, the horse to which the mares had all been bred the year previous. Colonel had a white hind fetlock and a stripe in the face, and Acteon was perfectly free from white. George T. Allman, of Tennessee, says: "I bred a bay mare, black points, to Watson, a son of Lexington, who is a golden chestnut, large star, both hind and near front ankles white. After dropping her foal I bred the same mare to my saddle-stallion, Prince Pulaski, a very dark chestnut, no white save a very small star; this produce was a *fac-simile of Watson in every particular.*"

Miles gives instances where calves show like influences by previous bulls. A pure Aberdeenshire heifer was served with a Teeswater bull and had a first-cross calf. The following season she had a calf by a pure Aberdeenshire bull, which calf at two years old had long horns, the parents being both hornless.

This mysterious influence is not confined to horses and cattle, as we see by the following, and many other similar facts that could be adduced.

Drs. Miles and Shank, of Lansing, Mich., saw a litter of pigs, got by a pure Berkshire boar out of a pure Berkshire sow. More than half the pigs were apparently Poland-China in the form of the head, and their bodies were spotted with sandy-white. The owner told them the sow, had been bred the year before to a Poland-China boar, and had by him a litter of pigs that were marked as Poland-Chinas. Dr. Miles knew the Berkshire sow to be a pure bred sow and her stock had never before shown any variations from the pure Berkshire type.

Of sheep and dogs and chickens, we could give like striking examples, but we think enough have been given to show breeders of pure stock that they can not afford to cross their females with any but pure bred males of good color and form, for the impress made on the females does not end with the produce of that cross.

So sensitive is the female to the influences of the males while in heat, that even the association with other animals of different markings or breeding have been known to affect the offspring of the female. Mr. Mustard, of Angus, in Scotland, had a cow that came in heat while in a pasture adjoining one in which a horned ox with black and white spots was grazing. He broke into the pasture where the polled Angus cow was and stayed with her until the cow was brought home to the bull. The cow and the bull that served her, as were all the cattle on the farm of Mr. Mustard, were hornless and black, but the calf of the cow that was in company with the horned black and white ox was marked like the ox, and had horns. This, with many like cases, shows that the mental impressions received at the time

of heat are deep and lasting, and oftentimes sufficient to stamp the progeny. Chicken fanciers, who breed to a feather, can fill a volume with instances where their best bred fowls have been injured by associating with ill marked or strange breeds

Farmers, who would attain high excellence in their stock, and poultry, will see to it that no such adverse influences as ill-bred crosses or mongrel associates be allowed with their stock.

Valuable Hints.—Dr. A. S. Heath, president of the Farmers' Club of the American Institute, New York, has given some principles and facts of such great value, that we reproduce some of them :

“The structures of animals are especially adapted to their demands and natures, and vice versa. A special aptitude to fatten is incompatible with ample milk production, in the race of bovines; and excessive weight of body and shortness of limbs in the horse or hog is not suggestive of fleetness. Variation is observed in the readiness of animals to adapt themselves to new conditions, and the changes it produces in them, and especially by hereditary transmission to their offspring.

“Cold, exposure, and neglect produce degeneration, while care, shelter, and liberal feeding improve existing animals and their expectant offspring. These good results may also be freely transmitted to the progeny. Climate modifies both animals and plants. In tropical climates, with rich soil, many of our small grasses attain gigantic growth; and in great altitudes, with poor soil, both plants and animals are dwarfed. By judicious breeding, care, kindness, and liberal feeding, all the animals and their products become better. Milk is richer, meat is finer, beef and mutton more tender and juicy, the very soil becomes fat, and the tiller grows richer and richer. Generosity to man, beast, and soil is profitable.

“Breeding animals must be healthy, free from defects of form, free from defects of constitution, free from predisposition to disease or weakness, free from ill temper or bad habits, must have sound digestive organs, and they must be capable of promptly and perfectly assimilating food. The breeder must intimately know the capabilities and characteristics of his breeding animals, so as to

be able to adapt them to rear young, which shall answer his preconceived wants. He must know that, all other things being equal, both parents equally exert the same amount of influence on their progeny. This presupposes the equal health, vigor, and stamina of both parents. Both should therefore be as pure-blooded and perfect as possible.

“Because it has been recommended that the male animal should be most highly bred, some have attributed to him the greater potential share in the procreation. This is only true because he is the parent of many annually, while the female is the parent of one, or of only a few during the same time.

“Though food, climate, soil, altitude, exposure, shelter, care, kindness, and other operating circumstances may all produce great changes, yet, all operating at the same time, and for a long time, on the animal and its progeny can not change the species. By selection, we, in time, breed small-boned into large-boned ones, long-legged ones into short-legged ones; we can breed horned into hornless, and light-bodied ones into heavy-bodied animals. In a word, by selection, the breeder can make the black white, the white black, the fruitful barren, the deformed straight, the perfect imperfect, the imperfect perfect; he can breed to a feather; he can produce a tendency to meat, to milk, to butter, to cheese, to capacity for labor, for speed, for endurance, or to serve almost any reasonable desire, demand, or fancy. By breeding from carefully selected parents, the breeder can rapidly increase his flocks and herds, by choosing those of great fecundity from which to breed—ewes from families that year twins, cows that uniformly breed, sows that farrow large numbers of pigs—and it is just as essential that the males, also, should be selected from like prolific families and dams.”

The terms “natural selection,” “the struggle for existence,” and the “survival of the fittest,” have been freely used by Darwin and others to convey the idea of nature and her methods to perpetuate her creatures. The wise breeder takes advantage of nature and methods to perpetuate the excellences which his acumen and judgment in the selection have secured for the art of breeding. There are many things to be constantly borne in

mind by the breeder ; the laws of variation, correlation, atavism, to the effect of climatic and telluric influences, care, kindness, feeding, and many other circumstances favorable or unfavorable to the modeling of form, to the production of animal products, to the perfection and perpetuation of desirable qualities, and the judgment, sagacity, and indomitable perseverance of the breeder must often be taxed to the utmost limit of human tolerance.

Though pure-bred animals are most desirable to breed from, yet in the great herds of the West there are few pure-blooded females to produce the vast herds and flocks imperatively demanded. We must therefore select the purest male animals to cross on our common females ; and upon our best females of the first produce to breed up by the use of the same male, or one of like purity of blood. In-and-in breeding need not be feared if the selection be judicious, and the process be not too long continued. But the mistake too often committed in careless, thoughtless breeding is, the use of grade males. Grade females are indispensable in extensive breeding ; but a breeder had better mortgage his farm, if need be, to secure pure-bred male stock-animals, than to use unreliable grades that can not transmit with any degree of certainty the good qualities they may possess, and one too apt to transmit defects. If size is desired, as a general rule, breed from mature animals. But for milk production, in all animals, early breeding is most essential. Cows are not profitable after eight or nine years of age, for any purpose, unless they be of extraordinary excellence. Ewes cease to be at their best at the same age as cows, though, if highly bred and valuable, they may still be further bred. Mares have brought forth the most valuable foals between the ages of four and fifteen years.

Low, rich, succulent pastures are best suited for large, heavy animals ; small, active animals to high, thin, dry pastures. Luxurious feeding diminishes hardness. Low, wet, pastures produce big, coarse bones, and large, flat feet in horses. In the wild state the strongest males only beget offspring.

Improvement in breeding goes step by step to the highest point of excellence. "Prof. Tonner has shown that the lungs

and liver of highly improved breeds are considerably smaller than in those animals at perfect liberty.”

The farmer or breeder who by intelligence and skill adds to the value of his live-stock ranks among the public benefactors and creators of wealth. There should be no rivalry between the farmer and the breeder. Their interests are one and inseparable. The farmer seeks the animal that will produce the quickest and largest returns. It is the breeder's business to produce such an animal.

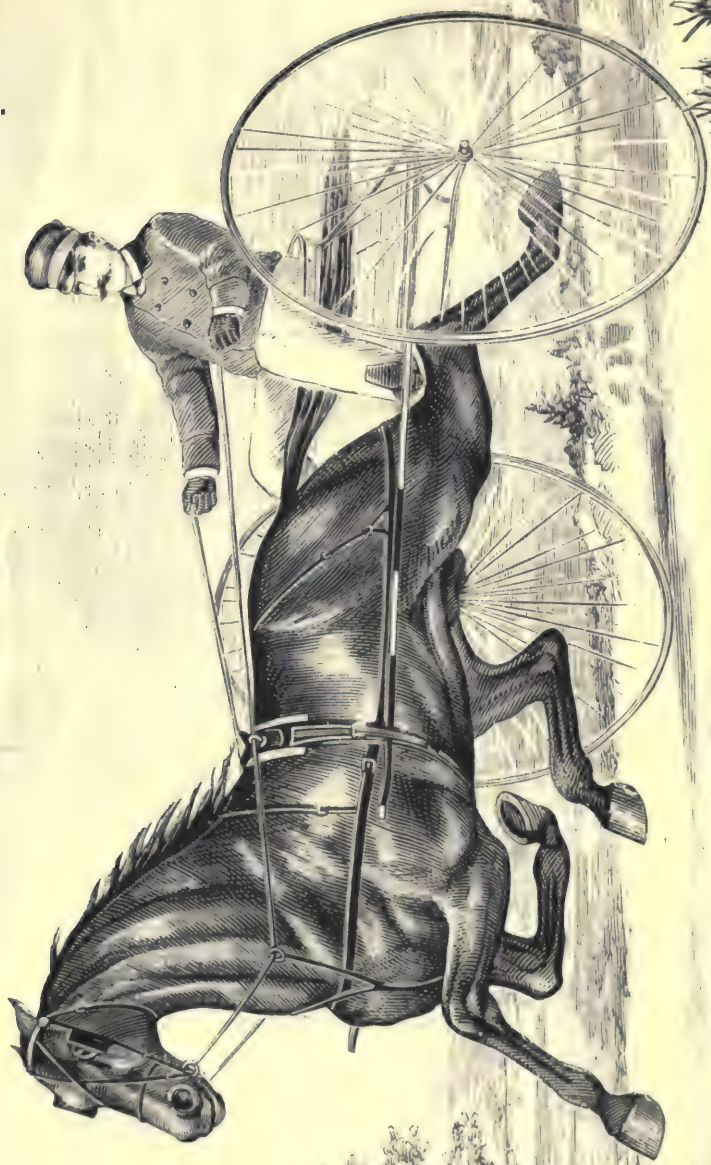
CHAPTER III.

THE HORSE—BUYING AND SELLING.

WHY Difficult.—From the earliest writings on the horse down to the present, writers have recognized the generally acceded fact that but few men understand the nature and construction of the horse so thoroughly as to enable them at all times to know his value with enough accuracy to buy with sure confidence.

Xenophon attempted to tell his readers “how a man may be *least deceived* in purchasing a horse.” No writer has been able yet to tell how a man may *never be deceived* in buying a horse. There is no article which men buy and sell that is so complicated in all its mechanism, and no animal whose temperament and intelligence and good training are of so much importance in giving value to it. Appearances are deceitful in inanimate articles of trade, but how vastly more unknowable are the mysteries of organization, breeding, and training of this noblest of all dumb animals. The Romans had a motto, “Let him who is about to buy a horse beware.” Moderns may well adopt it. It is not possible to give rules so complete that the average buyer will be enabled at all times to buy wisely. We hope, however, to offer hints that may be helpful to all who may need to buy a horse.

What is Unsoundness?—Professor Coleman has said, “Any deviation from nature is an unsoundness.” In a general way, this is true. Yet, for the purposes of the buyer, it is not strictly true. If this rule is to be drawn closely, no horse that has been kept at work regularly, however light the work may be, until he is eight or ten years old, can be called sound. The mouth, the shoulders, the joints of the limbs, will all show the



"ALMOST," TROTTER STALLION, OWNED BY COL. R. S. WITHERS, LEXINGTON, KY.

effects of use, as will the hands of the artisan or day laborer. Yet who will say the calloused hand or toughened mouth is evidence of unsoundness? The hand and arm and foot of the day laborer are enlarged unnaturally when compared with those of the man who lives at ease and in idleness. The mouth, shoulders, and limbs of the colt which has done no labor may be in a natural state, but after a few years' work they will not be so. The chances are, too, that if the young horse has been well handled, this very "deviation from nature" will add to the value of the horse as a laboring animal.

The rule must, then, be taken with reasonable limitations. Like many of the terse apothegms of our language, it may sometimes serve as the edge-tools of speech to cut the knots of difficulty. For this use it is retained by courts, and too often applied by judges that know too little of the wonderful nature of the horse to always so wisely apply the principles of law as to meet the ends of justice. It behooves the buyer, then, to "beware," and use diligence to understand the defects and ailments, or "deviations from nature," that are common to horse-flesh.

Warranty.—A warranty may be general or particular and limited. A general warranty does not extend to defects which are known to the buyer, or readily discovered. High authority says that a warranty is not implied simply because a full or sound price is paid. The old rule, *caveat emptor* (let the buyer take care), prevents this. But this rule never applies to a fraud. Mere silence of the seller is not construed as a fraud. Affirmations of quality, made to secure a sale, may be regarded as a warranty. In England the seller said to buyer, "You may depend upon it, the horse is perfectly quiet and free from vice;" this was held to be a warranty that the horse was quiet and free from vice.

If a horse is ordered from a dealer for a special purpose and does not fit that purpose it may be returned; or if damages follow, it has been held that the seller is responsible. It makes a difference if the buyer selects; he then takes the risk. If a man says to another, "Sell me a horse fit to carry me," and the latter sells him a horse which he knows is unfit to ride, he

will be liable for the consequences; but if the buyer says, "Sell me that grey horse to ride," and the seller knows at the time the buyer will not be able to ride it, that would not make the seller liable. Had he said, "Sell me that grey horse *if* he is fit to ride," and the seller sold it knowing he was not fit, he would be liable.

The warranty commonly given is in the form of a receipt:

Received of A. B. — dollars for bay gelding, warranted only seven years old, sound, free from vice, and kind to work.

Signed,

— — — — Seller

The word warranted is limited to things named in receipt; and the qualities desired or bought should be named in the warranty. This warranty covers every unsoundness that can be detected or lurks in the constitution at time of sale, and to every vicious habit that the animal had hitherto shown. To recover or return, it is incumbent on the buyer to prove the animal unsound and viciously disposed at time of sale.

The Definition of Unsoundness given by Youatt is more extended than that of Professor Coleman, and we close this subject with it: "The horse is *sound* in which there is no disease, nor any alteration of structure in any part which impairs or is likely to impair his natural usefulness. That horse is *unsound* that labors under disease, or that has some alteration of structure that does interfere, or is likely to interfere, with his natural usefulness. The term *natural usefulness* must be borne in mind.

"One horse may possess great speed, but is soon knocked up; another will work all day, but can not get beyond a snail's pace; one with a heavy forehead is liable to stumble, and is continually putting to hazard the neck of the rider; another, with an irritable constitution and washy make, loses his appetite and begins to scour if a little extra work is exacted from him. The term unsoundness can not be applied to any of these; it would be opening far too wide a door to disputation and endless wrangling. The buyer can discern, or ought to know, whether the form of the horse is that which will render him likely to suit his purpose, and he should try him sufficiently

to ascertain his natural strength, endurance, and manner of going. Unsoundness, we repeat, has reference only to disease or to that alteration of structure which is connected with or will produce disease, and lessen the usefulness of the animal."

Vices and Disabilities.—Any thing that lessens the horse's power to labor detracts from his value. There are some things which offend the eye only, but do not lessen the power to work. *A rat tail* offends the eye, but does not injure the horse for work. For a horse-power or bark-mill a blind horse may do better than one with good eyes; but for general work or driving, blindness or weak eyes may be named as a serious disability. A lame horse is useless; a vicious horse is dangerous. The tail carried to one side, or the tongue lolled, may not offend one buyer or injure the animal for labor, but detract from value, so it is difficult to sell him. We may name a few vices and disabilities the buyer must avoid.

RESTIVENESS.—This comes from bad handling and from a too eager disposition. It tells of a nervousness or impatience that develops easily into a multitude of vices, such as rearing, backing, bolting, balking, and even viciousness in shoeing, when badly handled. The restive horse is easy to be made an inveterate balker. It is difficult to cure when it becomes a confirmed vice. Gentleness and patient firmness of the trainer must cure and prevent. Many an ambitious horse is ever ready to start, unless he has been taught never to start until the word is given. It is easy to train the average horse not to start until the lines are drawn and the word given. Horses are usually less to blame than the drivers for the habit of starting too soon.

BITING is evidence usually of a cross disposition. Yet many horses have acquired it from the vile and inexcusable habit of boys and grooms teasing them.

KICKING is a vice that is intolerable, and difficult to prevent in some strains of horses. Too often, however, it is the result of carelessness in allowing the habit to become confirmed. The fact that the young horse kicks when first put in harness should not discourage the trainer, but lead to great care to prevent its repetition, for it is a habit easily confirmed.

RUNNING AWAY is a vice seldom cured. It is difficult to detect by the buyer. The habit once confirmed is incurable.

SHYING is a vice that may come from nervousness, or defect of vision. Near-sightedness is a common cause.

CRIB-BITING AND WIND-SUCKING may or may not be classed as a vice. We deem it an unsoundness. It surely is an objectionable habit, and detracts from value.

CUTTING OR INTERFERING may not be called vices, rather disabilities, which disfigure and detract from usefulness.

OVER-REACHING OR FORGING, AND CATCHING OR STRIKING the front shoe with the hind foot is more serious, and attended with so much danger to horse and rider that it may well be classed as a vice. Young horses, shod heavier in front, and heads reined up well, may outgrow the latter, but the old horse is hopeless.

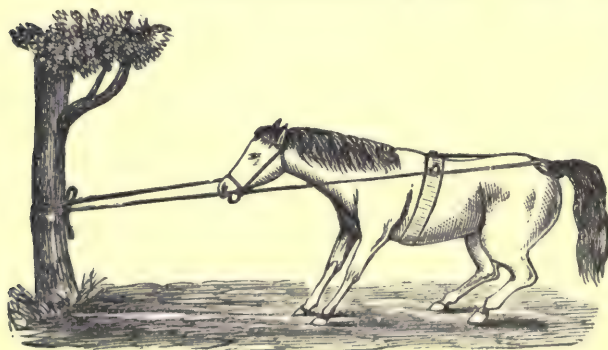
PAWING, when in harness, at the hitching-post, or in the stable, indicates a restless disposition. It is a serious defect, and often is a vice.

SLIPPING THE BRIDLE OR HALTER is a vice attended with danger, and is incurable. A strap that passes around the neck is the safest hitch for such horses.

PULLING AT THE HALTER is a vice. It can be cured and pre-

vented. The method of curing by passing a rope under the tail is here illustrated.

SPEEDY CUT, interfering, broken knees, stumbling, all tell of defective formation, and the marks



HORSE PULLING AT THE HALTER.

are generally in sight to tell the buyer of the habit and weakness.

STUMBLING argues an imperfect formation or a weakness, which may be natural, or arise from a strain or injury. It is a disability, which by bad usage and punishment may become a vice.

ROARING AND WHEEZING show an alteration of structure in air passages, arising from disease or injury. Such alteration interferes with perfect freedom in breathing, and constitutes unsoundness.

THICKNESS OF WIND argues disease, weakness, or over-exertion. It may be detected by placing the ear beside the wind-pipe, after putting a horse to his speed. It is a safe thing to test every horse in this way.

COUGH argues irritation of throat, or lungs, and may be classed an unsoundness.

HEAVES AND BROKEN WIND argue unsoundness. When once begun it usually increases. Heaves are caused by over-exertion or bad feeding. Dusty hay provokes it.

Long, fast, driving against a strong wind immensely distends the air cells, and irritates and even ruptures lung tissue. Having the stomach much distended by heavy feeding provokes the disease, preventing free action of the lungs. Heaves and thick wind may be alleviated, but not cured. Light hay-feeding, and change of climate are most beneficial.

The Eyes.—The buyer can not inspect the eyes too carefully. The horse with perfect eyes, it is said, never shies, unless badly handled. The diseases of the horse's eye are not numerous, but occult. A good, clear light from above is best for inspection of the eyes, as from a sky-light. With the horse directly under it, with no light from any other source, the eye may be examined so clearly as to show every defect. The next best light is to put the head of the horse at a stable door, looking out. The buyer, then, by standing to one side, within doors, can inspect one eye at a time. Then stand before the horse and look through both eyes into the stable. Because one eye is perfect does not necessarily argue the other is equally good. Any derangement of the eye is considered an unsoundness.

WHITE OF EYES.—The eye which shows much white at the front corner that is nearer to the nose indicates usually a hasty, nervous temper, and if the animal be used roughly, will develop a violent nature. Occasionally an eye with an unusually

small iris, may show much white, and yet the animal have a mild temper, but in such a case the expression will be entirely different from that of the former. One has an expression of mildness and confidence, while the other expresses rage or fear.

The Feet.—"No foot, no horse," is an old maxim telling concisely the value of the foot to the animal, whose value depends so much on its ability to move freely and long.

Because contraction of the hoof is so common among horses confined to stable floors and hard roads, and maltreated by farriers and blacksmiths and grooms, the buyer of small experience jumps at the conclusion that a large foot is better than a small one.

A naturally small foot on man or horse does not argue unsoundness or weakness any more than that because the man or horse has an uncommonly large foot he is uncommonly strong or powerful.

The small foot may be more perfect than the large one. The inside of the foot may be injured by the contraction of the horny shell, caused by heat or dryness of the stable, and inflammation aggravated by stimulating food.

The horse reared on the softest and wettest ground, would have large, flat feet, liable to injury and disease, when taken to hard roads and dry stable floors. The horses reared on dry, hard, and stony plains, like the Arabians, would have compact, hard feet, that do not so easily suffer by a change to the stables and streets of cities. Soundness or unsoundness can not be predicated from the size of the foot alone. The form tells more than size as to the value of the foot. The medium size, with a uniform structure of bone, not heavy in front or too thin on the side, or wanting at the heel, is the most desirable. The flat foot, with a convex sole, and low heel, may be sound, but is liable to give way under hard usage.

THE PUMICE SOLE, lower in the middle than at the sides, is to be shunned. The thousand laminæ in the foot that act as springs to ease the shock are weakened and the coffin bone is let down and presses on the sole, and as there are no means

for lifting it back and keeping it there, the animal never will be sound.

LAMENESS, from foot or any other cause, is an unsoundness.

SAND-CRACK, QUARTER-CRACK, AND CORNS, may each be classed as an unsoundness.

THRUSH is an unsoundness too common among farmers' horses. It tells of want of cleanliness in the stalls, and neglect. It may first be detected at the cleft of the frog. It is a diseased condition of the secretives, and can be detected by the smell as well as by the sight. If the frog is not too much involved it is easily cured, and the buyer will need experience to know the extent of injury done by its presence.

CONTRACTION is not necessarily an unsoundness, but care should be taken to ascertain that there is no heat about the quarter; that the frog, though diminished in size, is not diseased; that the horse does not step short, and favor its feet as if tender. The slightest lameness proclaims an unsoundness in such case.

The Limbs.—RING-BONES are situated above the hoof. This disease is an ossification of the cartilages at the top of the coronet. Until it is seen approaching the heels, the flexibility of the cartilage is not lost. Although it often spreads slowly, and the horse is able to do slow work, yet there is always a tendency to spread, and the animal must be pronounced unsound.

SPLINT, OR SPLINT.—If it is not near a joint, and does not press on any ligament or tendon, it may not be the cause of unsoundness. The location of it is to decide its character.

BROKEN KNEES, if healed, may not be an unsoundness. They are a warning, however, to the buyer to look well at the foundation of the leg, and see if the fore quarters and hind are in proportion, and the action straight and true. The high, thin withers tell nothing here. The deep, sloping shoulder, thick at the point next the back, is better than the tall withers and upright shoulder. The best of horses may fall, with bad rider or driver. The cut knee is hardly enough to condemn him if his form and action are good.

CAPPED HOCKS may be occasioned by lying on an uneven floor, with scant bedding, or by kicking. If from the latter, it tells of a vice. A special warranty is advisable.

CURB, OR CORB, is an unsoundness while swelling remains. It is a hard bony enlargement at the back of and on lower part of the hock. "Whether a curbed horse is sound or unsound, is a matter of dispute," says Howden. If large enough to be readily seen, they are blemishes. While they are forming, and come from strain, kicking, or blows, the horse is lame and unsound. The curby leg is an offense to the eye, but no evidence of weakness. A curb may be sprung suddenly, and a buyer will have difficulty in returning an animal on plea of curb.

CUTTING.—The speedy cut is seen on the inside, and on hind edge, and lower corner of the knee. It is occasioned by a weakness, or awkwardness, or working beyond the normal capacity. When the horse can not travel at ordinary gait with an average driver without cutting, he is to be rejected.

SPAVIN.—Whether bog, bony, or blood spavin, is an unsoundness. This is an enlargement on the inside and rather toward the front of the hock. It is produced by an over-exertion. Bog spavin is a wind-gall on the inside front of the hock joint. After the heat and inflammation are gone, it is of minor consequence. Blood spavin is the enlargement of the thigh vein, where it passes over the inside of the hock. It never produces lameness, but it always offends the eye. It may be produced in an instant, by a severe strain or bruise. When an enlargement of the joint is produced, there is commonly a lameness at starting. Some call it then bone-spavin.

THOROUGHPINS are a wind-gall in the hock. They are quite common among horses that have done much work. Unless they cause lameness, the horse is considered sound.

WINDGALLS are situated at the bottom of the cannon bone on each side of the leg, at the union of the two bones, just above the pastern joint. They are soft, and seldom cause any inconvenience. They are evidence the animal has done work. They usually disappear with age, or when horses are long rested, or lightly worked. They are not evidence of unsoundness.

STRINGHALT is readily detected by the awkward jerk or catch of the leg. It is usually supposed to arise from inflammation of the sciatic nerve, or an excess of energy. It may increase to an unsoundness, and while it usually detracts very little from the usefulness of the animal, it injures the sale greatly.

GREASE, OR SCRATCHES, like cracked heels, usually is caused by bad grooming, or neglect in filthy stables and yards, attended with grass feeding, and want of regular exercise. They argue a low state of the system. When long neglected, they become obstinate, and some horses of a sluggish nature take on the ailment every spring or winter. In case of long standing, it is an unsoundness. If of recent appearance, it can be easily cured, and then the animal is ranked sound.

SWOLLEN LEGS argue a tendency to dropsy and farcy, and is a sure sign of debility. They are difficult to cure, and horses long afflicted with this are useless for any but slow work. Mild forms of it, called "stocking," appear from long standing still. Young horses are more subject to it from this cause than old ones. Hence the young horse should be allowed the freedom of a box-stall or yard when not in use. It is a symptom of weakness, and, in mild form, disappears with exercise.

ELEPHANTIASIS OR LYMPHANGITIS is kindred to stocking, but an aggravated form of long standing. It is a species of surfeit, showing plethora. It usually appears in one hind leg, sometimes in both. It may develop by the horse standing from Saturday to Monday, when the animal is fat and surfeited. The lymphatic glands of the leg become inflamed and weak, unable to perform their functions, and the fluid oozes through or infiltrates the cellular tissue and makes the leg like that of the elephant. No cure.

ENLARGED JOINTS are most common among horses running in the meadows, or those used for hunters. When the enlargement is free from heat, and has become hard and does not interfere with the action and capacity for work, the horse may be considered sound. The enlargement is a blemish. If, however, the joint becomes feverish from hard exercise, it is an unsoundness.

OVER-REACHING is catching the toe of the hind shoe against the heel or shoe of the fore-foot, injuring the foot or straining the limb, and endangering the rider. It is a vile habit which jockies and farriers tell you shoeing will correct. Until shoeing, and boots, and pads make over the anatomy of the over-reacher, this fault will exist with danger.

FORGING is a clicking of the hind and fore shoes when trotting. The point of the hind shoe may touch the heel of the fore shoe, but usually it strikes the web of the fore shoe when the foot is clear of the ground, and the bottom presented to the hind one. This is called also "clicking," "shovel and tongs," "poker and tongs," and, like over-reaching, shows a defect in formation. The belly is usually too short for the back, or the back is long in proportion to the belly, or the body is short and legs long. The clicking of untrained colts may not be classed an unsoundness unless the form is such as to indicate it will be a habit that training will not correct.

If the proportions of back, belly, and limbs are reasonably good, and the young horse clicks on a jog, we have found he usually abandons it after a few weeks driving. It is not then safe to class it as unsoundness.

DAISY CUTTING or abnormally low action tells of tender feet, strained muscles, or need of rest at pasture. It may be classed unsoundness until corrected by rest.

CLAMBERING is an abnormally high action, too high for practical or easy work, but is not an unsoundness.

KNEE-SPRUNG though not a disease in itself, is the effect of a disease. When legs are good, the center of gravity passes through the center of the limbs and touches at the heels. The sprung knee may be from defect in formation, or from sprains of the metatarsal or suspensory ligaments; long continued soreness in the feet, shins, joints, etc.

CALF-KNEE OR CALF-LEGGED is a weakness or defective formation where the knee falls back of the line of gravity. *The legs of sound horses are straight from the elbow to the fetlock.* Any deviation from that detracts from value. The greater the deviation the less the value of the animal.

COCKED ANKLE, like knee-sprung, is a mark of previous injury, or ocular evidence of local weakness. It is known by the ankle-joint being thrown forward like a knuckle, and for this reason it is sometimes called knuckling. In the great majority of cases it is only a symptom. The cause will be found in the feet generally, or in sprains of suspensory ligaments, or tendon passing over the fetlock.

SWEENEY is a wasting of the muscles of the shoulder-blade. It is usually caused by a bruise from a bad-fitting collar, or at heavy loads, or plowing, or having the head pulled to one side by wide checks or a jockey-stick. The farmers' colts are more liable to it than any others, because of faulty collars, want of care in having the young horse comfortable and well-arranged in his harness, and in the wagon or plow. The head should always be in a line with the spinal-column when plowing or pulling. Any deviation from this for any length of time, overtaxes the muscles and causes a weakness, manifested in a shrinking of the same. Rest will usually restore the muscle. If allowed to run on without rest or treatment, it becomes chronic, and extends to the leg and affects the heads of bones, and permanent lameness results. Not all shoulder-lameness is sweeney. In fact, sweeney is rather exceptional.

UNNERVING.—There is an operation performed for navicular disease and ailments of the lower limbs, known as nervotomy, or unnering. Its purpose is to deaden sensibility to pain and prevent limping, or it may be performed to give higher action and a harder, heavy step. The buyer can easily discover whether the operation has been performed if he will pass the finger and thumb along the back sinew, and notice if the horse catches up the foot sharply as the fingers press on two little knobs or lumps. Now, if the little scars over these lumps be pressed and the horse jerks up the leg suddenly, he may safely conclude nervotomy has been performed. How long the horse will work after this operation is all chance. He may work free from pain for years. In some cases it is a humane act to unnerve, as it may save pain and enable the horse to be useful.

Howden tells of a mare used in the coach-line between Car-

lisle and Glasgow, which had been unnerved for the navicular disease. "One dark night, about three months after the operation, the coachman felt her drop, but she recovered herself and ran to the end of the stage. She was then discovered to be very lame," and it was found the whole foot was off, which, the next morning, was found two miles back, and the courageous animal had made that distance on the stump of her leg."

The pluck and courage of the horse excels that of any other animal. He will drop dead in the struggle for victory, but never flinch, though his leg be broken or he feels the sword or bayonet pierce his body. His patient endurance invites the cruelty of hard-hearted men, and makes him the victim of untold sufferings, because of an owner's recklessness or caprice, or love of display and victory.

The Back and Body.—**CHINKED BACK** is an injury of the vertebral column, caused by over-weighting or sudden pulling up when the head is high. It comes on instantly and makes the horse unsound, though he may long continue to work. When he drops on the pastern of hind legs when mounted, or grunts or winces under pressure of the affected part, there is suspicion of the injury. Knuckling of the pastern-joint may come from this injury.

HIPPED, OR LOW HIP, is a term applied where one hip has been knocked down. It is a fracture, and the broken part is drawn down by contraction of the muscles, and unites below its original place. As soon as it is healed within, the horse ceases to go lame, and is considered sound, though blemished.

SADDLE GALLS, arise from injuries by the saddle. The galls under the gag-rein hook are akin to these, and alike painful and difficult to permanently remove. The cause must be removed, or continued use will result in

SIT FASTS, which are large calloused tumor-like lumps. Any treatment but cutting them out is almost useless.

SADDLE-BACK, CRADLE-BACK, sway-back, or any deviation below the line of a level broad back, detracts from value, as all these depressed backs lack the support of a well formed vertebrae, and bear a weight at mechanical disadvantage.

ROACH-BACK is the reverse of the sway-back, yet like it is a deviation from the normal line of strength, and lessens power or strength. It is often produced by causing colts or young horses to draw too heavy loads. When the back is weakened it becomes an unsoundness. The short, level, broad back, filling up well back of the shoulder and between the hips may be taken as the ideal, and departures from it avoided.

LONG WAIST is a horseman's term, used when the animal is long between the last rib and haunch bone. It is apt to be associated with a light loin, a narrow loin. Long waist, narrow hips, all tell of weakness, and generally go together.

HIGH HIPS, are unsightly, and usually owe their prominence to the narrow and poorly developed loin. High hipped horses are usually long waisted. Horses possessing these marks are washy, easily "gaunted," or thrown off their feed by a hard task, and easily purge on a journey. Large hips of themselves give great leverage, and if with them the loins are full, and the animal "well ribbed up," the wide hips give great power.

LARGE BARREL, or middle piece. A good large barrel-shaped middle piece, with the broad hips and full loin and level back, complete the points that show powers of endurance and vitality.

POT-BELLIED, is a term applied to the animal abnormally large in the barrel. It tells of grossness, sluggishness, and lack of endurance and pluck. It may be a good point in a milch cow, but is wholly unbecoming an animal whose value arises from action and endurance.

HERRING-GUTTED is the opposite of the large round barrel, and is indicative of the nervous, irritable disposition that comes along with poor digestion or improper assimilation of food. It is akin to the narrow chest and slab-side. All tell of defect in strength, temper and endurance, as no animal defective in lung and digestive power can be of the best form and temper and quality. In the horse as the human, temper and power to endure arise largely from the character of lungs and stomach, as well as from the head and heart.

General Hints to Purchasers.—Experience and a practiced eye can only enable one to be a skillful buyer. The

inexperienced lacks a correct idea of the animal suited to his business. In fact, he does not know a good horse when he sees it. He is as likely to buy a diseased horse as a sound one. If he needs one for his plow or cart, he may buy an upheaded, long backed, nervous brute, wholly unfit for his use. The first thing, is to know what you want. This necessitates consideration of size, form, make, power, endurance, temperament, disposition, and avoidance of defects and disabilities named before.

Notice first the head, the eye—its expression, form, color and condition. By the head and eye you are to judge of the temperament and disposition and qualities. This word qualities means much; of its full import and value you can not tell without extended trial.

If the buyer is not acquainted with the horse and owner, and has little or no experience in buying, he will fare better to employ an expert to buy for him. The faults, defects, and vices of horses and men are so numerous, and sellers are so artful in covering up, that even the shrewdest and most experienced buyers are deceived at times.

If the head and eyes are satisfactory, next scrutinize the legs and feet. See that the legs are not too long, that they are set under the horse properly, that the fore legs are straight from elbow to pastern, well muscled, knee broad and well articulated; that they are short between the knee and pastern, flat, clean, bony, sinuous, and muscles strong and well defined. If the muscles are properly developed, stand boldly out from the bone, and are free from fattiness, they can be traced by the eye. The hind leg must not be crooked, the hock must be deep, clean, and strong. The horse must stand squarely, on four legs, and equally, and they must not be stretched too far apart or gathered too much under him. Notice if the limbs are clean, free from bunches or lumps. After the eye, pass the half closed hand down each leg, carefully, with moderate pressure, to learn if there are bunches or scars or splint or windgalls concealed by hair. Give special care to the hocks, for spavins, curbs and thoroughpin, which disfigure and depreciate, though they may not hinder usefulness. If at any lump or enlargement there is sore-

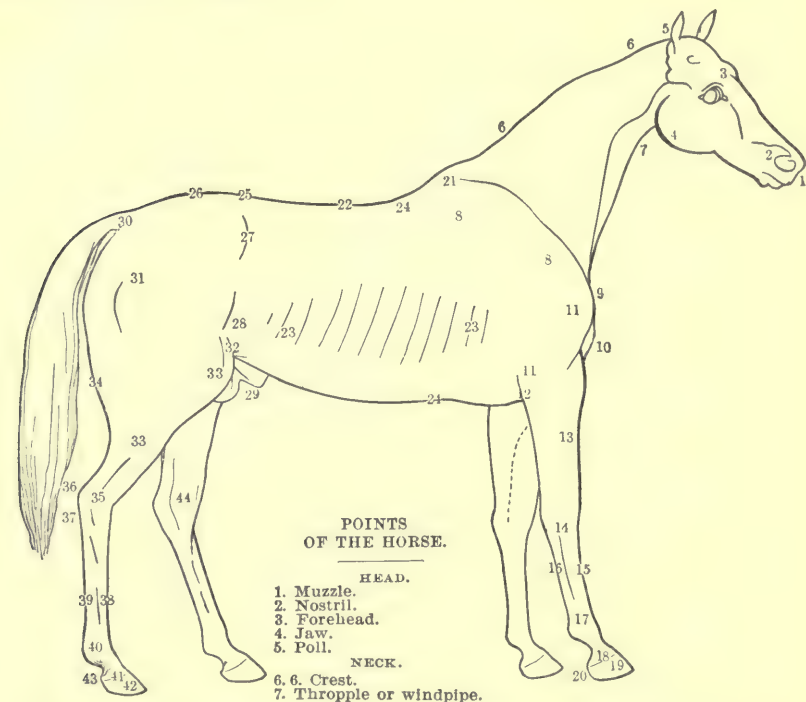
ness, reject that animal. Next lift each foot, and feel around coronet for ringbone. Notice shape of foot, then the sides for quarter crack. See that the heel is broad, and the horny case sets squarely and does not turn under on the ground or shoe. Look at the frog for thrush; see that frog is full and sound, and the hollow of the foot is arching and not depressed. A white foot is never as tough as a black one. The horse with split or flat-foot will never be fit for other than slow work. The feet with high and narrow heels are said to be more liable to founder and contraction. "No foot, no horse," is true.

Next look at the body. If the ribs are round, back short, loin broad and full, and wind good, he will be useful. Test his wind by causing him to trot or run sharply a hundred rods and return, and then let him stand still. Notice closely his breathing. If he takes at once, on stopping, a long breath or two and breathes easily, without any appearance of inconvenience or distress, his wind will do. Sometimes by placing the ear at side of the wind-pipe or lungs, one can detect if there is any irritation there. Heaves or broken-wind can not be too carefully guarded against. A cough, or the enlargement of the gland below the ear, must be watched. They are precursors of evil.

Now, have the horse moved past you on level ground. Stand where you can have a good view of him. Notice the action of the fore-legs, that the joint at the shoulder plays freely, that the feet are not raised too high and that he throws his feet out boldly, and is not cautious about throwing his weight on them. If he takes mincing steps and seems constrained in the use of his limbs pass him by. If possible, see the horse moved after a long rest. Many horses a little stiff in the shoulder will not show it if they have been warmed up by exercise.

By this time you have some idea of his style and appearance, but you will do well to take your position in front of him and have him trot toward you and directly from you. You can then see if he carries his feet forward in a direct line, and does not travel too close or too wide. If too close he will be apt to cut; if too wide he will appear awkward and his gait

laborious. Now, turn him short and quick; notice if his back and loin are flexible or stiff. If he is awkward and stiff about the hind parts reject him.



POINTS OF THE HORSE.

HEAD.

1. Muzzle.
2. Nostril.
3. Forehead.
4. Jaw.
5. Poll.

NECK.

6. Crest.
7. Throple or windpipe.

FORE-QUARTER.

8. 8. Shoulder-blade.
9. Point of shoulder.
10. Bosom or breast.
11. 11. True-arm.
12. Elbow.
13. Forearm (arm).
14. Knee.
15. Cannon-bone.
16. Back sinew.
17. Fetlock or pastern-joint.
18. Coronet.

19. Hoof or foot.
20. Heel.

BODY OR MIDDLEPIECE.

21. Withers.
22. Back.
23. 23. Ribs (forming together the barrel or chest).
24. 24. Circumference of the chest at this point, called the girth.
25. The loins.

26. The croup.
27. The hip.

28. The flank.

29. The sheath.
30. The root of the dock or tail.

THE HIND-QUARTERS.

31. The hip-joint, round or whirl-bone.
32. The stifle-joint.
33. 33. Lower thigh or gaskin.
34. The quarters.

35. The hock.

36. The point of the hock.

37. The curb place.

38. The cannon-bone.

39. The back sinew.

40. Pastern or fetlock-joint.

41. Coronet.

42. Foot or hoof.

43. Heel.

44. Spavin-place.

We have not spoken of mere matters of taste, such as color, style, and so on, nor is it necessary here. When one is buying a horse for his own use he may well afford to take time and care to select one that suits him. A good horse is of untold value and comfort. A mean one can harass the driver and do damage to his owner every hour. He may or may not be a companion and servant that is a source of pleasure and profit every day of his service.

CHAPTER IV.

THE HORSE—ANATOMY AND PHYSIOLOGY.

THE horse may be conveniently considered as a *system of organisms*, each having a special function or work to perform in the animal economy.

1. The *bony* system or skeleton, which is the frame-work.
2. The *muscular* system, which may be considered as the cords or tackling to move the frame-work.
3. The *nervous* system, which includes the brain and controls all other organs.
4. The *digestive* system, which prepares nourishment for the body.
5. The *circulatory* system, which is a system of canals for transmission of nourishment to all parts of the organism.
6. The *excretory* system, by which the unused matter is eliminated from the body.
7. The *generative* system, or organs, by which are begotten and delivered into the world the young of the species.

THE SKELETON.—The frame of bones of the horse comprises two hundred and forty-seven bones, distributed as follows:

1. In the skull, 10.
2. In vertebral column 48, divided as follows: Cervical, or neck, 7; dorsal or back, 18; lumbar or loins, 6; caudal or tail, 17.
3. In the face and jaws as follows: In face and lower jaw, 18; in each ear, 4; tongue, 5; teeth, 40.
4. In thorax or the chest, 37.
5. In pelvis, 3.
6. Bones of locomotion, 40 in front and 38 behind. The bones of locomotion *in front* include the scapula, humerus, os brachii, carpal bones, metacarpals, os suffraginis, os coronæ,

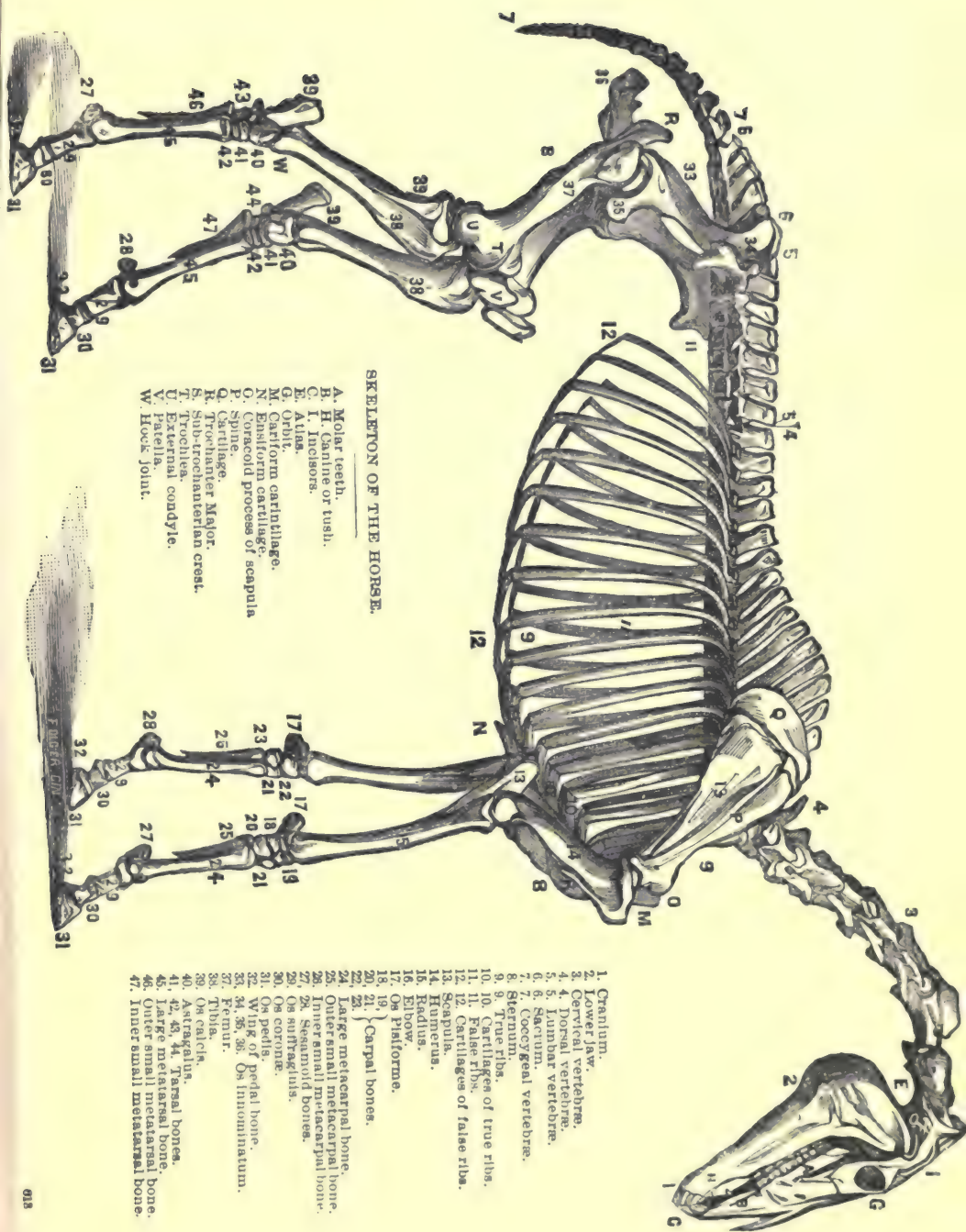
os pedis, os naviculare, ossa sesamoideæ—total, 20 on each side. The bones behind include the femur, patella, tibia, fibula, 6 tarsal bones, 3 metatarsals, os suffraginis, os coronæ, os pedis, os naviculare, 2 ossa sesamoideæ—total, 19 on each side.

By reference to the skeleton and names of bones on another page, the reader may be able to locate and understand the relation of each of the bones named above. It is an interesting fact that there is no essential point of difference between the bones of the human and equine races, except the teeth. The chief divergence between the bones of their faces, jaws, ribs, and pelvis is in form. The teeth vary in construction and material.

A careful study of the frame-work of the horse, in comparison with that of man, will reveal a striking similarity. Take, for example, the function and form of the shoulder-blades. It will be seen how strongly the humerus of the horse bears likeness to that of man. On this point a writer in the Farm and Fireside Library says:

“Next comes the radius, with its prolongation forming the elbow; next, the carpal bones, occurring in the knee of the horse, and in the wrist of man; next, the metacarpals, corresponding to the five bones of the hand, and which in the horse now number but three, viz: the large metacarpal or cannon bone, and the two small metacarpals or splints; but the researches of Marsh and others into the history of the fossil horse, have shown that the earliest forms of the horse probably possessed five metacarpals, with the corresponding toes, and that the one now left corresponds to the larger or middle finger of man. From this point down the relationship between the three bones below the fetlock, the lower one its *horny hoof*, with the three bones below the knuckle, the last one with its *horny nail*, is easily perceived.” In like manner the resemblances between the bones of hind limbs of the horse and the lower limbs of man may be traced.

The Frame-work an Index of Value.—It is of the first importance, that every breeder or buyer of horses, cattle, or swine should be so familiar with their frame-work as to be



SKELTON OF THE HORSE.

- A. Molar teeth.
- B. Canine or tush.
- C. Incisors.
- E. Atlas.
- G. Orbit.
- M. Cariform cartilage.
- N. Eniform cartilage.
- P. Coracoid process of scapula.
- Q. Cartilage.
- R. Trochanter Major.
- S. Sub-trochanterian cross.
- T. Trochlea.
- U. External condyle.
- V. Patella.
- W. Hock joint.

- 1. Cranium.
- 2. Lower jaw.
- 3. Cervical vertebrae.
- 4. Dorsal vertebrae.
- 5. Lumbar vertebrae.
- 6. Sacrum.
- 7. Coccygeal vertebrae.
- 8. Scapula.
- 9. True ribs.
- 10. Cartilages of true ribs.
- 11. False ribs.
- 12. Cartilages of false ribs.
- 13. Scapula.
- 14. Humerus.
- 15. Radius.
- 16. Ulna.
- 17. Elbow.
- 18. Carpal bones.
- 19. Metacarpal bones.
- 20. Phalanx.
- 21. Carpal bones.
- 22. Metacarpal bones.
- 23. Phalanx.
- 24. Large metacarpal bone.
- 25. Outer small metacarpal bone.
- 26. Inner small metacarpal bone.
- 27. Sesamoid bones.
- 28. Os navicular.
- 29. Os pedis.
- 30. Os metatarsi.
- 31. Tibia.
- 32. Femur.
- 33. Os calcis.
- 34. Astragalus.
- 35. Navicular bone.
- 36. Metatarsal bone.
- 37. Outer small metatarsal bone.
- 38. Inner small metatarsal bone.
- 39. Hock joint.
- 40. Carpal bones.
- 41. Metacarpal bones.
- 42. Phalanx.
- 43. Carpal bones.
- 44. Metacarpal bones.
- 45. Phalanx.
- 46. Carpal bones.
- 47. Metatarsal bones.

able to compare with reasonable accuracy their relations and proportions.

In rearing or buying horses this is of especial importance, since in the perfection of these parts the value is so largely dependent that without it other perfections of muscular development will not make amends.

Not only the relative proportions of length, size, and arrangement, but also the quality, solidity, fineness, or density must be considered in estimating values and uses to which the animal may be best adapted. The frame-work of the trotter and racer and draft horses has variations to adapt the parts to the use intended. The back of the cart-horse must be shorter and stronger than that of the trotter, his shoulders more upright and thicker than that of the animal to be used for speed. The saddle-horse must have a longer, finer pastern than that of the draft or farm horse, that he may have more ease, freedom, and elasticity of motion. Nor can one judge of the relative size and form of muscles that give form and power to the animal, until he can measure by his eye the form and size of the bony structure. The gracefulness, or ease of motion, the power of endurance, the degree of vitality, and constitutional vigor may be discerned through the form of the frame and the manner in which the muscles are attached and arranged on the frame-work.

The Muscular Development.—The functions and constitution of the muscles of the horse come under the same laws of development as those of man. A study of the works on human anatomy and physiology will aid in the study of this subject. The highest degree of health and vigor and form come with good breeding, proper nourishment, even of ancestor and offspring, and judicious training. The physiological law is never to be lost sight of, that *use strengthens, disuse weakens*. The muscles of the arm that never toils become soft, flabby, and feeble. The arm and sinews of the well-trained racer become strong and firm, and have the ability to do and to endure. The animal or man that spends days in confinement, deprived of exercise and sunshine, whose lungs are never taxed with inflation of air enough to quicken and purify the blood, becomes soft and

enfeebled, and a fit subject for disease. On the other hand, exercise and taxing the strength of muscle, without regular supply of nutrition to repair waste and wear, impairs and weakens muscular fibre.

It will be seen that the glorious mean between exertion and rest, moderation and abundance, is to be reached only by an intelligent understanding of the nature and wants of the animal economy.

Physiology of Muscle.—The movements of the body and limbs are performed mainly by that part known as “flesh” or muscle, which anatomists call “muscular tissue.”

In the half-starved “plug,” or highly-trained track-horse, in which the fat has almost entirely disappeared, we see nothing but muscles and their tendons, attached to and inclosing the bones beneath the skin-covering of the legs. On the trunk they spread out into layers and folds so as to give symmetry and protect the organs within the trunk, moving freely upon each other, and causing motion of the several parts of the body.

The *tendons* are composed of white fibrous tissue, and serve to connect the muscles to the bones. They are stronger than muscle, more compact, and not so easily injured by violence. They center about the joints and occupy less space, than muscle. The fibres are firmly attached to the bones, which at points of union are rough. This union is so strong that it rarely gives way. The bone will break or the tendon snap in the middle, rather than the union of the two loosen. Tendons are non-elastic.

The muscles are made up of fibres bundled and held in parallel lines by a fine membrane. These fibres under the microscope appear made up of finer fibres, united in linear direction by a fine filament. Now these finest fibres or fibrilla are made up of distinct cells, alternately light and dark. In the action of the muscle, these cells contract, shorten in length in proportion as they increase in width, causing the whole muscle to gain in thickness what it loses in length. It is a most interesting fact that this power of contraction and relaxation, called *irritability*, varies in different individuals according to the

vitality. Now as this pure muscular fiber appears to be identical in composition with the fibrine of the *blood*, we see the force of the expression "blood will tell," which means that a highly-bred animal has greater vitality, or, in other words, greater muscular power, than the mongrel.

The Blood.—The blood is supplied from the food by the digestive process. It furnishes all the tissues of the body with a constant stream of the materials which they severally need—at one time for nutrition, at another for secretion or excretion, functions performed by suitable organs, such as stomach, liver, kidneys, and so on.

The muscles demand fibrine and oxygen, combined in arterial blood. The nervous system can not respond to the calls of its grand center without having a due supply of fatty matter, in combination with oxygen, which the process of respiration affords, and also eliminates the excess of carbon. For these purposes the blood must be supplied with liquid elements, which are derived by absorption from the digestive organs. Its oxygen is supplied by means of the delicate lining of the lungs. Thus we see that the stomach, bowels, liver, pancreas, and spleen are all employed furnishing the fluid with grosser materials, while the heart, lungs, kidneys, and skin are constantly engaged in circulating it and supplying it with oxygen and *purifying* it from noxious salts and gases. The importance, then, of blood free from impurities is apparent.

This suggests to the farmer that the animal needs pure air to furnish the oxygen in due proportions. It needs pure water free from deleterious matters that if once taken into the system must be eliminated by the action of functions designed for this purifying process. The action of the skin is so important that we can not afford to tax the delicate inner organs to do what they might have been saved from by the groom's proper use of the brush and friction, and keeping the stable and bedding clean and free from impure air. The whole process of blood-making and nutrition calls for intelligent provision of appropriate food and water and air. Impurity of blood is the precursor of disease.

Physiology of Respiration.—The chief end of respiration or breathing seems to be the absorption of oxygen from the air, and the elimination of carbonic acid from the blood. Respiration is slower when the animal is in a state of rest than when in motion. Carbonic acid is constantly developed in the system by the decay of tissues, and by the conversion of carbon of the food which is used for the development of heat. The vigorous exercise of force augments the destruction of tissues, hence, the necessity of more rapid and deep breathing while the animal exerts power, that oxygen may be more freely supplied *to*, and carbon carried *from*, the blood. Here we see the wisdom of nature in providing the racer with such superior nostrils and lungs, and also an enlarged system of blood vessels, that so display themselves under the fine skin of the racer on the course. As the venous blood is brought into contact with the oxygen through the thin membranous lining of the lungs, we see the terrible tax placed on this organ by intense and long-continued exertion. Here arises the danger often incurred of producing rupture of these delicate lung cells and membranes, causing injury to the wind of the horse. From serious injury, whether caused by over-exertion or long exertion in extremes of heat or cold, inflaming the lungs, we have wind impaired and dangerous lung fevers.

Under favorable circumstances the blood enters the lungs, and is acted on by the atmospheric air, absorbing oxygen, while giving off volumes of carbonic acid gas. In passing through the small blood vessels, the arterial blood *loses* about eight per cent of oxygen, and *receives* about nine per cent of carbonic acid gas; and when the blood is exposed to the action of atmospheric air in the lungs, it *receives* oxygen and *loses* carbonic acid gas. By this the blood changes color from a dark red to a bright scarlet, or pure blood.

Physiology of Digestion. For the descriptive anatomy of the stomach and digestive apparatus, we must refer the reader to larger works on anatomy. We must be content with a glance at the physiology of digestion, that we may better understand the care and feeding of our domestic animals and ourselves.

Healthy digestion demands, complete mastication, and mixing with saliva. Hence slow eating is conducive to health, and bolting food is injurious. Saliva acts as a ferment in converting the starchy matters into sugar, which by the action of the gastric juice, is converted into the proteine compounds which go to the formation of flesh. The stomach of the horse being small, the food does not stay in it long enough to be converted into chyme, but passes into the duodenum, for that purpose. Here it is further macerated, and receives bile and pancreatic juice, through the pores of the inside of this organ, or intestine. The nutritious parts of the food are now gradually converted into chyle, and passes from the duodenum into the lacteals, whose mouths absorb the chyle. After the loss of its chyle or nutrition the food passes from the small intestines, which are about ninety feet long, on into the the large intestines, whence it is discharged as fæces or dung. The chyle is at once carried to the heart, passing through the liver, is purified and undergoes a chemical change.

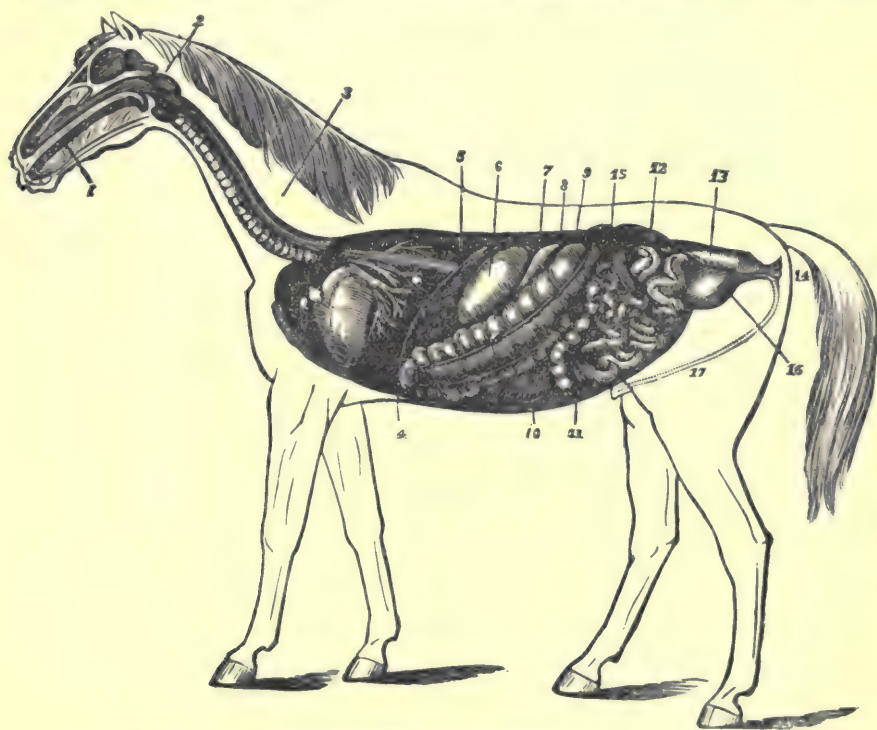
In the digestive apparatus of the horse there is a peculiar pocket called the cæcum, or "*water stomach*," which will hold about four gallons, while the stomach itself holds about three gallons. The office of the cæcum seems to be two-fold, viz: to hold the surplus of water drank more than the stomach will hold, and to retain food until the glands have extracted all nutrition from the mass. The innutritious part passes off as excrement. It is held in by bands or tucks in the intestines so the refuse comes along in little balls.

Secretion and Excretion.—*Secretion* is defined to be the process of separation of the various matters from the blood. Saliva, bile, etc., are known as secretions. These are removed from the blood for one or two purposes; first, to be employed for the various processes of nutrition or repair, or, secondly, for purification, or removal as injurious. This latter process is called *excretion*. How the cells select the good, and reject the bad, the cells of the liver select the bile, the salivary glands the saliva, and so on, is as mysterious, as how one tree will select acids for its fruit, and another in same soil will select sweets.

The most important would seem to be the selection of nutri-

tion from the food ; but the depuration or power to remove or eliminate impurities is so essential to life, that though the animal may live many days without the secretory organs taking up nourishment, yet if the depuration or removal of impurities of blood ceases but for a few hours, death must speedily follow.

If saliva and gastric juice and bile are not mixed with the food, nutrition will be imperfect and health suffer. If the ele-

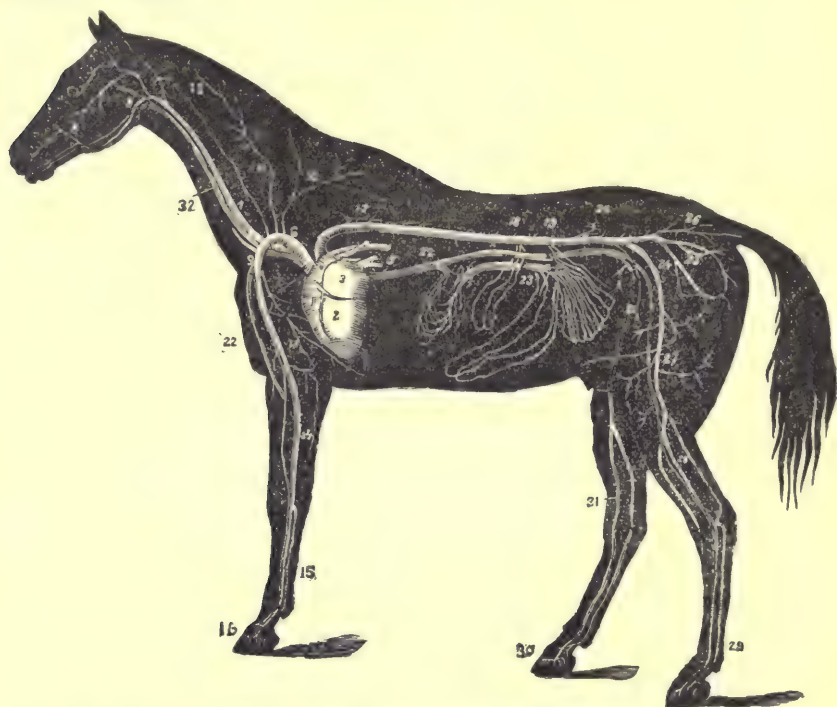


SECTION OF HORSE SHOWING DIGESTIVE APPARATUS.

1. Mouth. 2. Pharynx. 3. Œsophagus. 4. Diaphragm. 5. Spleen. 6. Stomach. 7. Duodenum. 8. Liver (upper ext.). 9. Large colon. 10. Cæcum. 11. Small intestine. 12. Floating colon. 13. Rectum. 14. Anus. 15. Left kidney and ureter. 16. Bladder. 17. Urethra.

ments of bile and urine, for example, are not eliminated from the blood, the system is deranged and death must follow. Hence the importance of arranging the diet of our animals so that the processes of digestion, secretion, and depuration can be insured to go on harmoniously and without check. The chief organs for cleansing the blood of impurities, are the lungs, which remove carbon; the liver, which secretes bile; the kidneys, which get

rid of urea; and the skin, which bears off fluid and more or less of solid refuse.



CIRCULATORY ORGANS OF THE HORSE.

1. Heart—right ventricle. 2. Heart—left ventricle. 3. Heart—left auricle. 4. Pulmonary artery. 5. Pulmonary veins. 6. Anterior aorta. 7. Common carotid artery. 8. External maxillary artery. 9. Left axillary artery. 10. Dorsal artery. 11. Superior cervical artery. 12. Vertebral artery. 13. Humeral artery. 14. Radial artery. 15. Collateral of the cannon. 16. Coronary branch. 17. Posterior aorta. 18. Cardiac trunk, distributed to the stomach. 19. Mesenteric vessels. 20. Renal artery. 21. Spermathecal artery. 22. Posterior vena cava. 23. Vena portæ. 24. External iliac artery. 25. Internal iliac artery. 26. Sub-sacral artery. 27. Femoral artery. 28. Posterior tibial artery. 29. Digital artery. 30. Venous network of the foot. 31. Veins of the leg. 32. Jugular vein.

The Nervous System.—This system of the horse is similar to that of man. It is not so highly organized, and for this reason it is supposed the horse is not so liable to nervous disorders.

The sense of touch is necessary in man and beast to protect from harm. By it we discern temperature, and get the ideas of hardness, softness, etc.

It is located, generally speaking, in the nerves of sensation on the skin; and in the horse, the lips and nose are especially endowed with the sense of touch. The lips and feet are especially endowed with nerves of sensation.

The sense of hearing as well as of smell, seems to be more acute in the horse than in man, and yet the horse is less liable to deafness than man.

The Foot.—The structure of the foot is an object of wonder, and is worthy of more attention than we can here give it. It is so essential to the horse that we say, “No foot, no horse.” It is complicated in its mechanism and subject to severe use, and for these reasons is liable to many diseases and accidents. No other part of the animal is so liable to injury from hard work or mismanagement.

A reference to the following cut will show the parts entering into the composition of the foot, and the fetlock and pastern joint :

- A. Coffin or foot bone.
- B. Navicular or nut bone.
- C. Coronary or lower pastern bone.
- D. Upper pastern bone.
- E. One of the sesamoid bones.
- F. Cannon or shank bone.
- G. Horny frog.
- H. Sensitive frog.
- K. Sensitive sole.
- L. Horny or insensitive sole.
- M. Outer wall or crust.
- N. Laminated leaves or horny plates.
- O. Sensitive laminae.
- P. P. Tendon of the extensor muscle of the foot and coronary bones.
- R. R. Tendon of the flexor muscle of the coronary and foot bones.



SECTION OF THE FOOT AND PASTERNS.

It will be noticed there is very little space between the navicular bone (b.) and the crust, which together with the sole forming a case or shoe of horn for the protection of this delicate arrangement. When inflammation arises here, from injury, there is no room for swelling, and this causes most intense pain, as well as rapid disorganization of the structure itself.

The foot consists of three distinct parts: 1. The external wall or crust. 2. The sole. 3. The frog.

The CRUST reaches from the hairy skin to the bottom of the foot, averaging about three and a half inches, with a thickness of about a quarter of an inch, having horny fibers running parallel from skin to bottom of foot.

The SOLE is a horny plate at the bottom of the foot, which should be slightly concave. It is usually about one sixth of an inch thick, but varies, like the wall, in different horses. It is thicker where it runs back between the bars and the crust.

The FROG is the elastic triangular, horny cushion, filling the space between the heels, and placed directly under the navicular bone.

The crust and sole and frog are all fibrous. The crust is like whale-bone, the sole rather separating into scales; while the frog has finer fibers and a larger portion of gelatine, which keeps it soft and more elastic.

The hoof is developed by secretions from the blood, supplied by small vessels or villi at the coronet. The growth of the hoof lengthwise is constant, to make repairs or to make good the natural wear of the foot of the horse unshod. The weight of the horse does not mainly rest on the sole of the foot, but mostly on the coronary ligaments. So the weight is direct on the horny or whale-bone part. The elasticity of all the solid parts and of the coronary ligaments afford protection and relief from the shock of a blow of the foot on hard roads or paved streets. This elasticity should never be lessened by cutting away of part of the frog, as do many farriers, when preparing the foot for the shoe. Cutting the frog not only lessens it, but causes it to harden. There is no reason favoring the trimming of the frog, as of the crust, because its constant contact with the ground or floor, and its softer nature, cause it to wear away sufficiently.

Stonehenge closes his chapter on the foot with the following: "It will thus be seen that the foot of the horse is a most complex structure, which is liable to derangement whenever the hoof or horny case is interfered with, and this may occur either

from mismanagement in shoeing, causing mechanical injury, or from inflammation of the secreting surface, which will end in the formation of imperfect horn, or from punctures or other wounds of the foot. Perhaps in no organ does an injury so soon produce a return at compound interest, for the inevitable result is a malformation of the hoof, and this only adds again to the original mischief. Hence, it is that in the foot, more than in any other part even, prevention is better than cure, for in many of its diseases it happens that a cure can not be obtained without rest; and yet it is also the fact that the secretion of horn will not go on perfectly without the stimulus afforded of necessity by exercise. The position of the leg is such that its veins have a hard task to perform at all times in returning the blood from the feet, but when the horse is not exercised at all, they become doubly sluggish, and congestion in them is almost sure to occur."

The Mouth and Teeth.—In the mouth the process of digestion really begins. Here the food is ground and mixed with saliva. That part of the mouth that will command our attention is the teeth, as every horseman and buyer must know certain things concerning them, that he may tell the age. The lower jaw is somewhat narrower than the upper, but each contains the same number of teeth, and in pairs.

The teeth originate in the jaws and form little cells therein, in each of which is a delicate bag of jelly-like substance. It is there at time of birth, and in due time the jelly begins to change to bony matter. Enamel and a cement are supplied as the teeth begin to take form.

The first teeth are called milk teeth, since they appear while the colt depends mainly on milk for food. In course of time they are superseded by permanent teeth.

There are in each jaw *six incisors*, or nippers, *two canines*, or tushes, and *twelve molars*, or grinders. Each is made up of three distinct substances—cement, enamel, and dentine. These substances vary in texture, and by this varying quality the teeth are not so brittle as if all enamel, and the unequal wearing of the surface of each tooth makes a roughness similar to the

rough surface of the mill-stone, by which their grinding power is improved.

The temporary or milk teeth differ in shape from the permanent. They are smaller, and the neck, or fang, is constricted, while in the permanent teeth, which go on growing as they wear off on top, the diameter is greater and gradually diminishes, holding the thickness well.



FIG. 1.—MILK INCISORS.

The natural size and form and markings of the milk incisors of lower jaw are shown in Fig. 1. The two central teeth are called *nippers*, and are seen in the mouth at birth. The pair, one on each side of nippers, are called also *middle teeth*, and



FIG. 2.—SIX MONTHS' MOUTH.

appear about the middle of the second month. By the sixth or ninth months the next outside pair, called corner teeth, ap-

pear. By the end of the first year these six incisors, reach their full size. The first teeth differ from the permanent, in being more rounded in front and hollow towards the mouth, showing the outer edge at first much higher than the inner. After the foal begins to use them in eating, the outer edge wears down, but the corner nippers keep their original appearance.

Fig. 2 shows the inside view of the lower jaw at six months. The central nippers are almost level, and have the black "mark" in the middle of each, wide and faint. The *outer* edge, but not the *inner*, of the middle teeth now show wear. About the ninth month the inner edge of the middle teeth will appear worn.

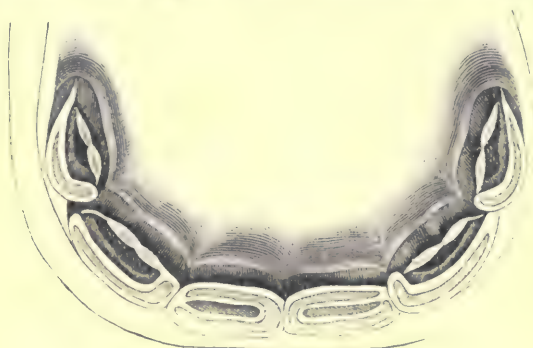


FIG. 3.—ONE-YEAR-OLD MOUTH.

Fig. 3 shows the lower jaw at one year. The outer and inner edges of all the nippers are partly worn, excepting the inner edges of the corner teeth which have not come to that yet.



FIG. 4.—TWO-YEAR-OLD MOUTH.

Fig. 4 shows lower jaw at two years. At a year and a half the "mark" in the central pair becomes very faint from wear;

the second pair is worn flat, the mark not so faint; the corner teeth are flat and mark clear. If colts are reared on hay and grain, the teeth wear down much faster than when grass alone is fed. At two and a half years the colt teeth begin to shed, as shown in Fig. 5.

Before going to an examination of the permanent teeth, let us notice that the foal is born with two grinders in each jaw, above and below, or they appear the first week. Within one month they are succeeded by a third, next back of them. By

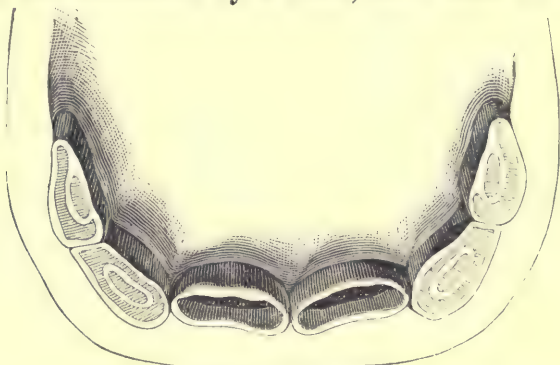


FIG. 5.—TWO-AND-A-HALF-YEAR-OLD MOUTH.

the end of the first year a fourth grinder usually appears in each jaw. The fifth grinder shows at two years. But as the grinders are difficult to see, we will confine our investigation to the front teeth. By the third year the mouth has become so large that the colt teeth do not fill the space. Now nature has provided for this, and the permanent teeth are formed below and are beginning to absorb the roots of the colt teeth, preparatory to their easy falling out. The permanent teeth sometimes push up beside the colt teeth and show themselves too soon, and then are called *wolf's teeth*. Now, as the teeth are beginning to change in form, let us attend to that more particularly before passing to the three-year-old mouth.

A nipper is undergoing constant change in form from birth to old age. The wear of the teeth calls for a corresponding growth, but in fact, the growth of the tooth is more rapid than the wear. Consequently we find the teeth becoming inconveniently long by the time the horse has reached his twentieth

year. Figure I. shows the shape and appearance of the face or level of a three-year-old nipper as it comes through. II. shows same tooth at six years, the crown worn off one-fourth of an inch. It is narrower and thicker than at three years. III. shows this tooth at twelve years. The breadth and thickness are nearly equal, and the crown or face has become nearly round. IV. shows the tooth in an eighteen year-old mouth. Quite oval. V. shows the tooth at twenty-four, the reverse of its condition in the three-year-old mouth. Its depth is greater than its breadth about two-fold. These diagrams give a correct idea of the character of the change going on, and will help to understand the difference between mouths of various ages.

In the third year the second dentition begins and takes place in the same order in which the milk teeth appeared. During the third year the grinders begin also to be visible, so that by the end of the third year the sixth grinder appears, but grows very slowly. By the middle of the year the nippers show wear on outer edge, and the middle teeth are pushing through. The corner teeth, of remaining foal teeth, are worn down, and the mark has disappeared in a great measure.



FIG. 6.—CHANGES IN FORM OF TEETH.

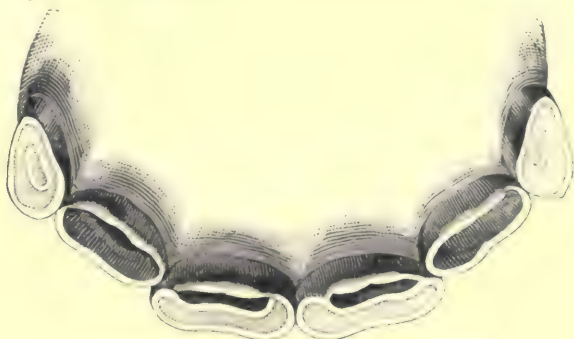


FIG. 7.—ADVANCED THREE-YEAR-OLD MOUTH.

By this time the foal teeth are all gone. The nippers show wear on both edges, and the outer edge of middle teeth is worn.

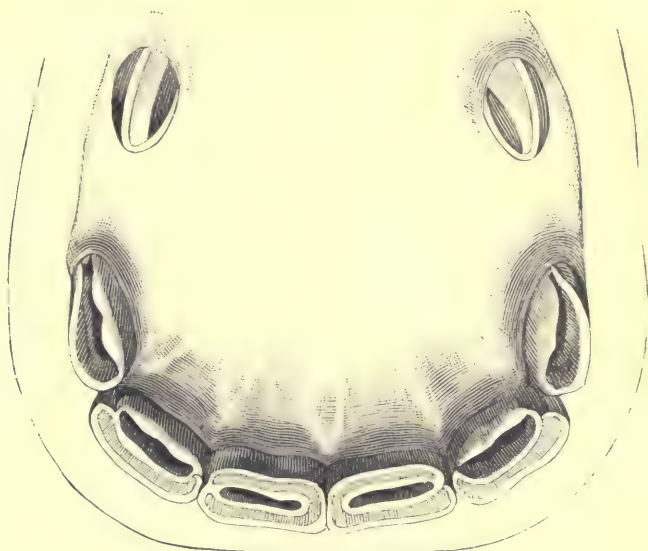


FIG. 8.—ADVANCED FOUR-YEAR-OLD MOUTH.

The tushes are just appearing. Some jockeys knock out the corner nippers at four years, to make the horse appear older by five or six months.

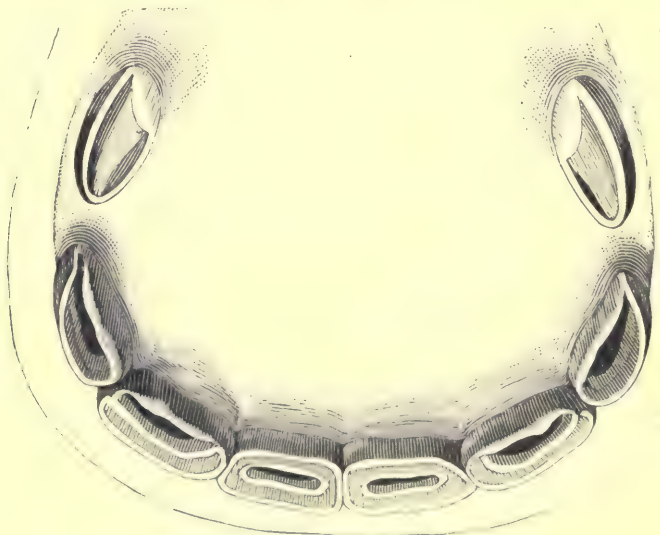


FIG. 9.—FIVE-YEAR-OLD MOUTH.

At five years the number of teeth is complete. Figure 9 gives inside view of lower jaw. The nippers are worn down on both edges, so there is only a small black speck in the middle of a smooth surface, while the next or middle teeth show wear

on outer edge to a degree that the inner edge begins to show worn. The corner teeth have the outer edge worn but little. The tush is full-grown, and does not show any wear. Its outer surface is regularly convex, and its inner concave, the edges being sharp and well defined. The sixth molar is full-grown, and the third is shed to make room for the coming permanent grinder. These last two named molars should be examined when there is any doubt about the age. After the fifth year there is no further shedding of the teeth. The horse now is said to have a "full mouth."

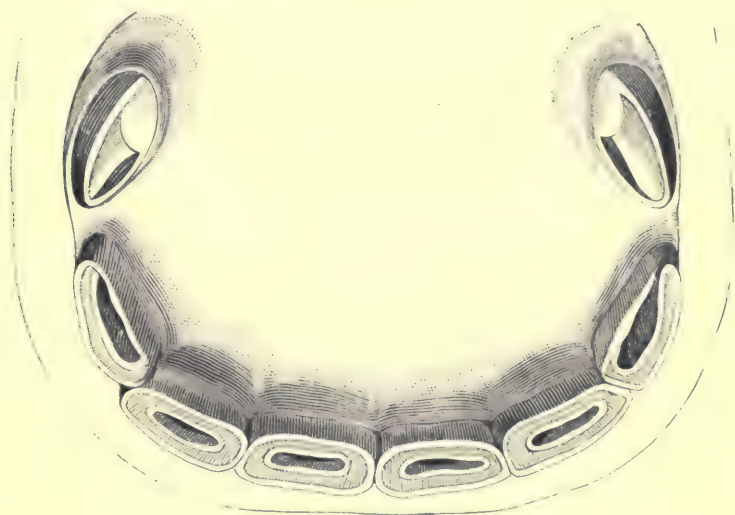


FIG. 10.—MOUTH AT SIX YEARS.

This figure shows the lower jaw at six years old. The nippers are worn down even with the middle teeth, which have still a cavity. The inner edge of the corner teeth is also worn down even with the outer one. "The six-year-old mouth is the last one" says Stonehenge, "upon which any great reliance can be placed, if it is desired to ascertain the age of the horse to a nicety, but by attentively studying both jaws a near approximation to the truth may be arrived at." "It is ascertained that the nippers of the upper jaw take about two years longer to wear out than those of the lower; so that until the horse is eight years old, his age may be ascertained by referring to them nearly as well as by the lower nippers at six." But as the

amount worn is one of the chief factors in the problem of telling the age, it must be noticed that the teeth of some horses wear rapidly. Crib-biters and wind-suckers wear off the upper teeth wonderfully soon. Horses accustomed to grazing on sandy pasture lands will show older mouths than those on clay lands.

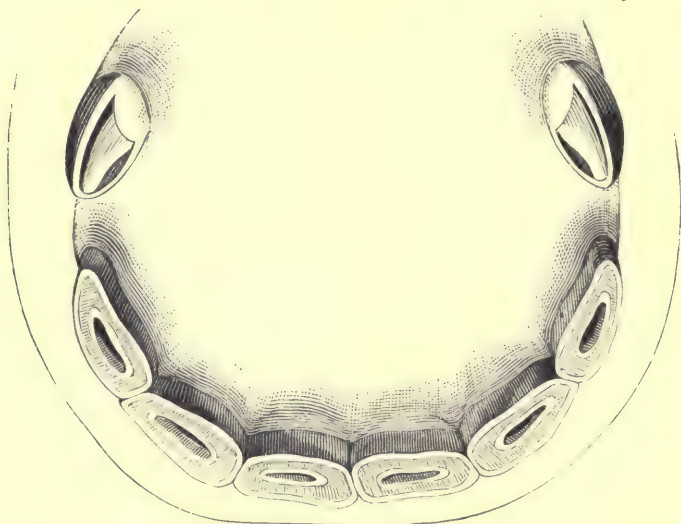


FIG. 11.—MOUTH AT SEVEN YEARS.

This figure represents the lower jaw of a seven-year-old. The tushes have become dull at the point and somewhat rounded by wear. Both edges of the corner teeth are worn smooth, with a small cavity on the face. The middle teeth have lost their cavity or mark, and show an even surface.

In Fig. 12 we see the six teeth all equally worn, and only a slight mark in the corner teeth. The edges of the tushes are worn down almost half. The upper tushes are more worn than the lower ones.

BISHOPING, named so from the scoundrel that invented it, now comes in to deceive the inexperienced. It is a means of making the naturally smooth crown or surface show the marks of a six or seven-year-old. With an engraver's tool a hole is dug out in the corner teeth usually, to imitate the "mark" of the seven-year-old. The hole is then burned with a hot iron to give the black stain. The careful examiner will notice this stain is more diffused, and the cavity not so well defined as



FIG. 12.—MOUTH AT EIGHT YEARS.

nature has them in younger horses. Horsemen, after the eighth year, look at the nippers of the upper jaw.

The *upper jaw* at nine years is here shown. The mark in the corner teeth is comparatively deep and clearly defined; the

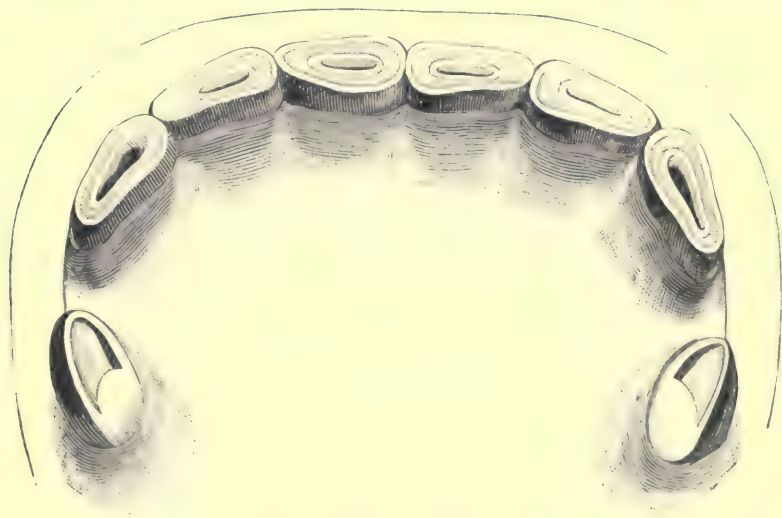


FIG. 13.—MOUTH AT NINE YEARS.

mark is still visible in the middle teeth, but it has almost entirely disappeared from the nippers. The inner edge is worn

down also. The section of each nipper now appears more triangular than oval.

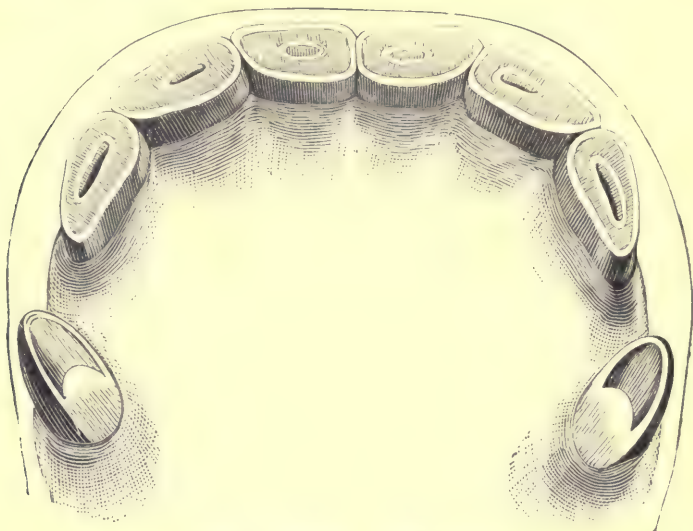


FIG. 14.—MOUTH AT TEN YEARS.

At this age we notice the oval surface shortening. The mark in the middle teeth is worn down, but it is still visible in the corner teeth. The corner teeth wear into a curve, as they grow longer, and do not bear so directly on the lower ones.

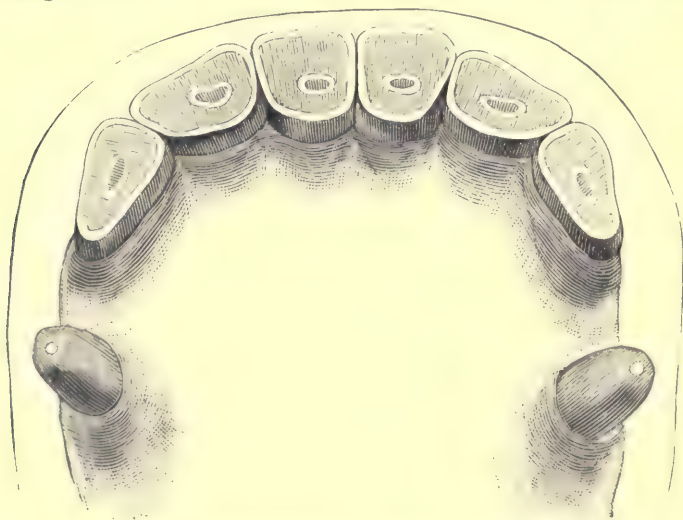


FIG. 15.—MOUTH AT FIFTEEN YEARS.

Fig. 15 shows the triangular form disappearing, especially in the nippers. The corner teeth retain yet something of the triangular form; the tushes are becoming more blunt; the teeth longer and further from a direct line, or from bearing one upon another.

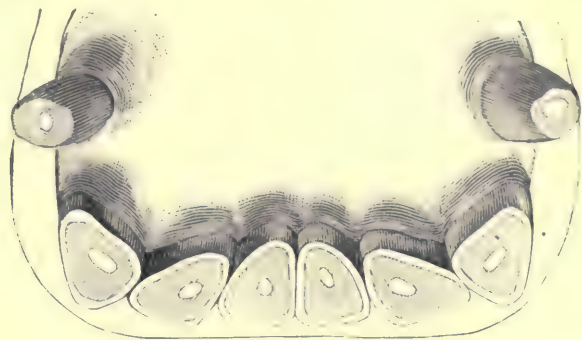


FIG. 16.—MOUTH AT TWENTY YEARS.

The corner teeth now have become triangular—deeper from front to back part. At twenty-one, the angles have disappeared from the teeth, and all are oval; but this is reversed, being deeper from outward, inward. As the horse advances in years the teeth grow thicker than they are broad, and as this thickness increases, the space between the teeth increases. As the teeth increase in length, they become of a dirty yellow, with occasional streaks of brown and black. The gums recede and waste away, and the tushes wear to stumps, and project directly forward, and often one or both drop out.

Irregularities of Teeth are by no means uncommon. The practice of punching out the milk-teeth, to hasten growth of permanent set, induces growth in a wrong direction, and, not meeting the opposing tooth, they do not wear down regularly. A horse occasionally has what is called a “pig jaw;” that is, the upper longer than the lower, in which case the teeth grow to so great length as to interfere with taking food.

Diseases of Teeth.—Fortunately the horse is singularly exempt from diseases of teeth common to man. The edges of grinders sometimes wear unevenly, and the sharp edges cut the cheek and cause ulcers. The cure is to rasp off the sharp edge with a tooth-rasp. Many a horse has suffered from neglect of

this. Occasionally a grinder is not met by its fellow, and it grows to such great length as to interfere with grinding of food, and to penetrate the bars opposite, and cause ulcers. The remedy is to saw off the tooth as often as it may demand. A horse with irregular teeth is unsound, and of little value. A carious tooth may produce disease of jaw and other teeth. It should be removed.

Dentistry is making the life of the horse more comfortable, and also increasing his days of usefulness. The hammer and punch are means of torture, and are superseded by other devices for extraction, which are more humane, and do not leave the fangs in the jaw, as the hammer and punch so often do.

When we reflect on the nature of the changes going on during the third and fourth years, we may expect to find poor mastication and febrile affections common at that period of life. At that period, especially, should the teeth have care. Youatt says, "The careful observer will frequently trace a fever, cough, catarrhal affections, diseases of the eye, cutaneous affections, diarrhea, dysentery, loss of appetite, and general derangement to irritation from teething." Under all febrile affections of young horses, the teeth should be examined. Mr. Percival, in speaking of treatment of gums by incision, etc., says: "In this way I have catarrhal and bronchial inflammations abated, coughs relieved, lymphatic and other glandular tumors about the head reduced, cutaneous eruptions got rid of, deranged bowels restored to order, appetite returned, and lost condition restored"



FIG. 17.—FRONT VIEW AT HALF YEAR.

CHAPTER V.

HYGIENE AND SANITARY CONDITIONS ON THE FARM.

IN this chapter we will speak of things which tend to the preservation of health. The term Hygiene comes from a Greek word that signifies good for the health. Sanitary laws are those that relate to preservation of health, or the prevention of disease. The importance of this is recognized in the old maxim, "an ounce of prevention is worth a pound of cure."

The air we breathe and the food we eat, as well as the manner in which we eat, or their conditions at time of being taken into the system, must be considered. The laws of sanitation that govern the health of men may be applied to that of all domestic animals, since all animals, whether biped or quadruped, depend for life on the air they breathe and the food and drink they consume. The conditions of heat and cold, moisture and drouth, cleanliness and filth, purity and impurity, all have their influence on the comfort and health of animals.

The Air.—The atmosphere is indispensable to life. It envelops and permeates every organism, whether animal or vegetable. Its purity or impurity affects the health and comfort of all animals. So essential is it to all life, animal or vegetable, that the ancient philosopher Thales asserted, that "living beings are only condensed air." It may predispose or excite many of the epizootic diseases that sweep like a storm from east to west over our continent. With some of its conditions of temperature, or moisture, its motion or calm, or its holding in its composition obnoxious gases, or organisms, or germs, we witness outbreaks of disease that become a pestilence to desolate the land. A sudden change from heat to cold is a recognized cause of disease. It acts suddenly on the capil-

laries and nerves of the skin, and causes the former to contract, and the skin loses its power of depuration, or carrying off impurities arising from exhausted air, and tissues relax in the processes of assimilation and exhalation, and the blood, unpurified, is driven to the lungs and membranes of the air passages. The blood is abnormally charged with waste materials, and the organs on which the work of the skin is thus thrown become inflamed and congested, and disease follows.

The history of nations has shown that the *dry* atmosphere is unfavorable to the spread of contagious diseases, while the moist or hot and damp atmosphere is most favorable. This may arise from two causes. First, the evaporation from the skin is imperfect, the textures of the animal less elastic, and as a consequence the circulation is languid. Second, the hot, damp atmosphere favors the rapid development of fungi of a parasitic nature, whose hurtful germs are rapidly and indefinitely multiplied.

Ventilation.—From this we see some of the reasons why pure air, and protection against the extremes of heat and cold and moisture, are desirable. Of course, man can not control these in nature. They are variable with the latitude and elevation and characteristics of the country. Man can never make the deltas of the Nile and the Mississippi as healthful regions as are the elevated plains where the rivers have their origin. We can, however, in the artificial arrangements of dwellings, stables and sheds, see that the air is not vitiated, and its purity not impaired.

DRYNESS of the atmosphere of the dwelling or stable is of the first importance. The horse has ever produced his highest type in a dry elevated region, where there was a pure, dry bracing atmosphere. The animals, of greatest activity dwell in dry and elevated regions. The sluggish animals like the hippopotami and pachyderms, flourish in the low marsh districts. The nature of the horse demands first of all a dry place to sleep and feed in. The damp stable favors development of fungi, decomposition of litter, dung, and urine, and waste of feed, all rich in nitrogeneous matter, which decays readily and defiles the

atmosphere. The dark, damp stable favors all fungous growth. Light and dryness destroy it. The damp stable is unfavorable to healthy action of the skin and lungs, and of all members used in depuration or purifying the system. Thus we see the train of ills that follow.

The Location of Barns and Stables.—If these principles be correct, we see that the site on which the dwelling of man or beast is located is a matter of first importance. Ventilation can never be so perfect as to keep the air of the inclosure dry and pure while the foundation and ground beneath are damp. *The site must be dry*, with a complete drainage. The old style of locating the stables on a hill where the manure would wash off out of the way, had its compensation, for though the farmer's soil lost much of the fertility from the manure, his animals gained the health and vigor that come with a dry undefiled atmosphere, in and around his barns.

In these days when farmers are learning to prize the riches of the manure, and are planning to save all and to increase its amount they need to be warned, that while they accumulate a vast amount of quickly fermenting material in, under, and around their barns, they are liable to contaminate the atmosphere by increasing its moisture, and permeating it with unwholesome gases. While the manure increases, let our care increase, that by the liberal and constant use of absorbents, we retain the wealth of the accumulating fertilizers and preserve the health of our animals. The increased value of the manure will never compensate for the injury to the health of the animals, that must be housed in the barns so many months of the year. True wisdom and economy will teach us not to gain one while we lose the other, but to secure both, richness and abundance of manure, with vigor and health of our stables and herds.

The barn should be located on an elevation sufficient to secure good and prompt drainage. A knoll with a gravel subsoil affords a natural drainage that will be prompt and efficient. It will be improved, if eave troughs and spouting be arranged so as to carry water far enough from the building to prevent soakage or dampness in the stables. There is no danger of having a

stable too dry ; but the dangers of a damp stable are constant and fearful.

Bank-barns.—The severity of our winters, convenience in handling feed, economy in feed and building material, together with the comfort of our animals, have led many farmers to build bank-barns. The writer has two, and knows something of their value and superiority. Yet, when he built them he was imbued with the idea of not only securing the comfort of his horses and cattle, but preserving their health. He abhorred a damp, cold stable. He sought comfort and health for his animals, and economy and convenience for himself. He believes he has hit the glorious mean. The barns are handy, comfortable and dry, and lighted and ventilated thoroughly. The winds of winter do not chill his stock, and the heat and flies of summer do not torment them.

Bank-barns as often built are damp, dark and most unhealthy places for horses. The darkness is injurious to the eyes, and that with dampness make the basement stable as usually arranged, a complete device for development of fungous growth and defilement of air and exclusion of sunlight and pure air. To secure dryness, the writer's barns are on elevations with a gravel subsoil, and under the walls are laid tile drains, and the water from the roofs is carried away with gutters and spouts so the foundation and floors are perfectly dry. To secure purity of the air and light, windows are placed in the east, south and west, so that every part of the basement floor is well lighted, and the sun shines in from three sides in the course of the day. The ventilators, connecting the basement with the cupolas in the roof, change and carry off the air from the basement so readily that there is never any close or offensive smell in the stables. It is a common thing for writers on sanitation and health to denounce in strongest terms all bank-barns. It would be as unreasonable to denounce all thoroughly built dwellings, because by their exclusion of cold air, they allow the air to become impure, and can not furnish as constant a supply of fresh air as can the open cabin with the huge open fire-place.

The length of human life has been increased by the improved science of building and increasing the comforts of man. The

better dwellings for man and beast are better lighted and better ventilated, and better drained than the old cabin, whose chief comfort was the huge blazing fire on the open hearth.

Light and Pure Air are essential to health of all animals. The experience of the last generation has brought out many facts to prove that health can not long be secured without them. As long as men lived in open air, or in cabins with huge wood fires, which changed the air of the house every few minutes, all attention to the laws of ventilation and sanitary science was neglected. As soon, however, as better houses were built, and they were heated by close stoves, some plan for artificial ventilation became necessary.

In 1830 an experiment in ventilation was made by scientific men at the Foundling Hospital, and at the Zoölogical Garden, in London. The results achieved were astonishing, and attracted the attention of intelligent men in all parts of the civilized world. By the improved ventilation in the hospital, the length of life of the foundlings was increased one hundred per cent. The same degree of improvement was found in the monkeys' quarters of the zoological garden. Under the old plan the children and monkeys had generally died of tubercles of the lungs and bowels. The impure air of their quarters had too little oxygen and too much carbonic acid. Consumption finds its victims in the homes where the air is impure, and the sunlight and fresh air have not free access. In the North where economy of fuel leads to close houses and stoves, there are more lung diseases than where the houses are open and fires are few, as in the Southern climes. The lesson of confined air often used, teaches that disease must ensue.

Impure Air Poisonous.—In the chapter on anatomy was noted the character of the action of the lungs. By considering the nature of the functions of respiration, we see it consists of two parts—viz: inspiration and expiration. By inspiration the air is taken into the cells of the lungs. Around these cells are vast numbers of capillaries or minute blood-vessels, wherein a peculiar work is done, as the impure blood of the system comes to be purified by contact with the oxygen of the air. The blood

is changed in color, the oxygen acting on the carbon forms carbonic acid, which is an impurity, and is thrown off by expiration into the atmosphere around us. The atmosphere that was inhaled contained oxygen and nitrogen. In that combination they are beneficial. As soon, however, as the oxygen has been acted on by the blood or lungs, nature throws off the nitrogen with the carbonic acid. Now, as nitrogen, in some forms, and carbonic acid are injurious to animal life, it will be seen how imperative is the demand that these do not again enter the lungs; but if the ventilation is defective, and fresh, new air is not furnished, the inhalation of the second-hand or oft-used air goes on to the inevitable contamination of the blood. We get a better idea of the amount of carbonic acid thrown off from the lungs by noting that Carpenter gives the average amount per hour set free by a full-grown man to be about one hundred and sixty grains, or in twenty-four hours about 3,840 grains, or eight ounces Troy weight.

Warm Stables.—As external cold increases the amount of carbon thrown off, we have an incentive to keep our stables warm in the winter. But in this we encounter another danger. The effect of several horses and cattle shut up in a close stable can be imagined. The air becomes laden with the excreted carbonic acid, and with the impurities added by the urine, dung, and decomposition of vegetable matter, increased by bad drainage, we have a stifling atmosphere.

It is not surprising that in the neglected stables we find sore throat, inflamed lungs, diseased eyes, grease or scratches, farcy, mange, and even glanders. Nor is it wonderful that when disease appears it spreads rapidly through the whole herd or stud, since they have all been exposed to the same kind of provoking causes. The heat of the stable sets free the nitrogen and hydrogen abounding in the vegetable matter, and in the dung and urine, and these gases unite and form ammonia, the salts of which were first made from camels' dung, in the district of Ammonia, in Africa. Hence the name. The ammonia is a pungent gas, and acts powerfully on the eyes and nose and lungs. Since any affection of the wind and sight of the horse

greatly damages the animal, it is a sufficient reason for extra care to secure good ventilation.

The custom of throwing the damp bedding forward under the manger, is a very damaging one. It defiles the feed in the manger, and the horse is compelled to breathe its poisonous fumes. The bedding is better to be removed from the stable entirely each morning. If this can not be done, then at least carefully remove all that is wet, and pile the remainder in the rear rather than under the nose of the horse. Since the days of close, warm stables, we note the disease of pneumonia, and lung troubles are increasing.

The Temperature of the Stable.—This is an important consideration. The extremes of heat and cold tax the system heavily. The office of the lungs and skin is so essential in the work of depuration or cleansing the system, that it can not be interrupted without danger. The lungs and skin of a man throw off about three pounds of carbon a day, and any thing that clogs or closes the pores hinders the process of respiration. It is well known that the normal condition is best preserved when the temperature is neither high nor low. About 60° to 70° in summer, and 40° to 50° in winter may be considered favorable.

Because a warm stable favors a glossy coat and less feed, grooms and owners are inclined to keep the stables close and tight, that the temperature may be kept up by the heat thrown off by the animals. The danger is two-fold. The air becomes vitiated and the animals debilitated. The coat of the horse or ox kept day and night in a warm stable does not thicken up enough to protect against a chill that comes when taken out of the stables. Unless there is constant and prompt attention to covering with a blanket as soon as exercise ceases, the animal is suddenly chilled, and the tax on the system is most damaging. If the stables are close enough to keep the winds from sweeping through, and to prevent all draughts of air on the animals, they will be comfortable with a lower temperature than when draughts are felt.

The farmer who uses his horses for slow work will not find

the coat of the horses getting too long in a stable of 50 degrees temperature. Those who use horses for fast driving, and warm them up to a lather, may find they can clean them more easily when the coat is light. For this reason the practice of clipping has become common. The clipped horse needs a warmer stable and must be carefully blanketed as soon as exercise ceases. In general, it is true that warm stables are close and ventilation is limited. Dangers of impure and impoisoned air increase as ventilation diminishes.

The Size of the Stable.—If the stable is to be kept close it must be greatly enlarged. A small close stable is but a dungeon or a pest-house. A man needs a bed-room containing 800 cubic feet, a horse needs one three times as large if the room is close. The size may be lessened as the ventilation is increased. Youatt says: "A stable for six horses divided into stalls should not be less than forty by sixteen, and the ceiling from nine to twelve feet high." If there be no ventilator connecting with the roof, the atmosphere of such a pen would be stifling by morning if closed tight enough to keep the temperature at 50 degrees when thermometer is below zero without. Gratings in the walls are not enough to secure pure air in the average stable.

Ventilators.—The farmer who has his horses and cattle in the barn where hay and other feed is stored, has an additional reason for providing ventilators connecting with the roof to allow the free escape of impure air. He is to provide not only pure air for his animals, but he is to protect his feed from contamination. Ventilating shafts may be so arranged as to do double duty. They can be used as exits for impure air and a great convenience in the mow for throwing down hay or straw.

The taller the barn the more readily can it be ventilated, as the draft will be better. A ventilating shaft 4x5 feet, or better 5 feet square, extending from the barn floor to the cupola in the roof, will keep fresh and wholesome the air in a stable where there are thirty to fifty head of animals. It may have at convenient points in the mow doors hinged at their upper ends, so as to yield readily to the fork full of hay and fall back as soon as the hay has dropped into the ventilating shaft. By

this device the shaft is always closed and no foul air from the stables comes into the barn or settles among the stored-up hay, oats, or straw. This ventilating shaft is promotive of health among the animals and cleanliness in the barn and feed rooms. The expense of such shafts is trifling when compared with the gains in a sanitary point of view.

Sub-ventilators.—As warmth in the horse stable, cattle barn, and pig pen is economical, being a saving of fuel in the form of feed to keep up animal heat it is the part of sanitary science to devise means for securing warmth of stables and keeping the air pure as nearly as possible. Since carbonic acid gas is heavier than common air, no system of ventilation is complete that does not provide for change of air at the floor of the building. Air brought into the stable through underground tubes gives warmer air and causes the removal of heavier air and impure gases so they can not accumulate to an injurious degree. The law of diffusion of gases causes the carbonic acid gas to be thus lifted with the nitrogen and oxygen and hydrogen and passed to the outer air by the ventilators. The system of supplying air of a higher temperature than outer air to the closely built stables is economical and health-giving.

Prof. Cook, of Lansing, Mich., has successfully adopted sub-earth ventilation for the College Apiary. The air entering by the sub-earth tubes or tiles is many degrees warmer than the surface air. By this means we can have a comfortable temperature and a pure atmosphere in our stables at a very small outlay. The cost of repairs of these devices is absolutely nothing, yet the benefits derived are very great.

A Vitiated Atmosphere is the source of more loss by disease to the farmers who have horses and cattle in close stables, and sheep and swine in illy ventilated pens, and poultry in noisome houses, than all other causes combined. The air that is expired from the lungs differs from that which was introduced into them not merely in the altered proportions of its oxygen, nitrogen and carbonic acid, but also in a large addition to its watery vapor, which from the lungs of a man ranges between 16 to 20 oz. a day.

And this vapor is not pure water. It holds in solution a considerable amount of carbonic acid and some animal matter, 3 parts in 1,000, which the best authorities now hold to be an albuminous substance in a state of decomposition. The changes of air and food and tissue in the processes of assimilation and depuration or throwing off refuse, are wonderful and essential to animal life and health. If we better understood the nature of this process, there would not be such a neglect of the means of securing to our families and herds and flocks an ample supply of pure air that can be had without money and without price, if we will but allow it to come in. Of the hydrogen which food contains only about one-eighth to one-tenth passes from the system by other excretions, the remaining seven-eighths or nine-tenths being exhaled in the condition of watery vapor from the lungs.

Predisposing Causes of Disease.—The lungs absorb continuously volatile matters diffused through the air. This is easily shown by the inhalation of turpentine affecting the urine. If we consider the astonishing effect of some substances when brought into relation with the blood in the gaseous form, we will realize in some degree the importance of preventing their inhalation by our animals. The inhalation of a few hundredths of a grain of arseniuretted hydrogen will prove fatal, causing the symptoms of poisoning with arsenic. Its effects on a human subject are not so violent as on some other animals. One-fifteen-hundredth part will destroy a bird, and one-eighth-hundredth part suffices to kill a dog, and one-two-hundred-and-fiftieth part is fatal to a horse.

Sulphuretted hydrogen and hydro-sulphuret of ammonia are given off from most forms of decaying animal and vegetable matter, and when confined, as in sewers, we have many instances of death caused by entering them. Carbonic-acid gas, which so abounds in our stables, is absorbed by the lungs of animals, and exerts a really poisonous influence. "The continued respiration of an atmosphere charged with exhalations from the lungs and skin, is among the most potent of all the predisposing causes of disease," says Carpenter.

The same high authority teaches that the presence of even a small quantity of carbonic acid in the air, taken in by breathing, causes a serious diminution in the amount thrown off, and of oxygen absorbed, hence the effete matter of the system is not thrown off perfectly, and the blood is contaminated thereby.

The Black Hole of Calcutta affords a remarkable illustration of the poisonous character of a confined and oft-breathed atmosphere. In 1756 one hundred and fifty-six prisoners were confined in a room eighteen feet square, provided with only two small windows. One hundred and twenty-three died in one night. Of the thirty-three who were found alive in the morning, many of them were cut off by a putrid fever, caused by contamination of the blood. In the crowded, close stables on too many farms of America, if we have not almost Black Holes of Calcutta, we have such shameful neglect of sanitary laws, and especially of ventilation, that the animals kept there are ready for any form of disease that may be introduced, while the occupants of well-ventilated barns and stables will escape many forms of epidemics or pass through without loss. We have given, perhaps, too much space to this part of our chapter, but it seems to us the bad ventilation of stables and pens is the prolific cause of disease and loss.

OVERCROWDING of school-houses, jails, etc., has furnished the history of epidemics with many striking illustrations of the increased danger to those who had been exposed to the damaging influences of crowded rooms before the outbreak of an epidemic.

The Stable Floor.—In connection with the subject of ventilation or keeping the atmosphere free from taint, the stable floor plays an important part. If the sole object of the floor were to keep the horse dry and clean, then an open or loose board floor would be the best. But, while this floor admits of quick drainage, it allows the urine to soak into the ground beneath, which defiles the foundation, and after the soil has been saturated, it gives forth gases most detrimental to health. The board-floor, too, is dryer than the ground, and the horse's hoof becomes as dry as the board, whereas the normal and healthy condition of the foot is to be moist and pliable. The board-floor,

too, that is high enough from the ground to avoid a harbor for vermin and fungus, endangers the limbs as the floors become worn or decayed from age and moisture.

On the whole, there are more objections to the plank-floor than to earth or brick, or cement or boulder-floors. The earth-floor is the best of all so long as it can be kept free from holes. If the foundation be well drained, and well packed by tamping as thoroughly as the dirt is packed about a post, a good clay-floor will last years if it has reasonable care. The writer has such a floor that has been in use five years and has never been repaired, yet there are no holes in it. The secret is in first having it well made and evenly packed with clean clay in which there are no stones or gravel. If packed and made as level and true as a board-floor, it will cost far less and last as long without repair as a board or cement-floor. It takes more bedding to absorb the moisture than the board-floor. This also protects the floor from injury by the feet of the horses. The feet of the horses that stand on the earth-floor are never so hard and dry as to be brittle, and the horses never slip or break through, and there is no harbor for rats and filth underneath.

The floor most usually recommended as best, is one made of good pavement-brick, set on edge on a good foundation of coarse sand. If the bricks are uniformly good, evenly laid on a foundation that will not settle in holes, we have in such a floor a satisfaction that does not come with any other.

The writer has a stable paved with cobble-stones, such as are used in street pavements. It has been in use now twelve years and has not come to repair. It has all the advantages of the brick, except that when there is most moisture the cement or sand that fills the crevices works out when the broom is used to clean the floor. By using the pavement-brooms we can clean the floor perfectly, and we have no defilement of the atmosphere from gases arising from fermentation and decay beneath. A well-made boulder-pavement has no superior for utility, neatness, comfort, economy, and sanitary conditions. The blacksmith who shoes the driving-horses kept on this floor says the horses' feet are in uniformly better condition than any horses

that come to his shop. The stable that has a brick or cobblestone floor, well laid on a foot of sand and gravel, and so arranged that rats do not undermine, has a floor that will cost less and give more comfort and security to health and against accident than can be had by any other method.

Let the floor be what it may, the comfort of the horse and saving of the valuable liquid fertilizer can be secured by abundance of straw, leaves, or saw-dust, while the bedding must be aired and the floors cleaned, so as to dry, each day.

If the farmer will arrange his stalls and windows so that while the horses are at work the floors can receive the sunlight and fresh air, he will add to the neatness of his stable, rid it of foul odors, and prolong the life and usefulness of his team, and if he has boys, will set them an example worthy of imitation. Cleanliness is of first importance in the stables. It is profitable for health and decency.

The Care of the Feet.—On such floors, where the bedding and filth are removed every day, we do not find disgusting cases of thrush and grease. The carefulness that provides such quarters for the horse also cares for the feet. The farmer who will clean his horses' feet in the morning free from manure and filth, will have them perfectly deodorized as they go to the plowed field. But if he leaves the frog bedded in manure, the loose earth packs and fills about the shoe, and makes a complete device for injuring the frog and inducing thrush, and injuring the structure of the foot. The roadster should have his feet cleaned night and morning, as he is likely to have a gravel wedged in beside the frog. We are here treating of *prevention* of ailments, and the foot needs special care, as it is a complicated structure that must be kept in good repair to insure the highest usefulness of the horse.

Cleaning or Grooming.—The practice of cleaning horses in the stall, and while eating, is a common one on the farm. It is convenient for the man to do this before breakfast, and while the horse eats, so that as soon as the morning meal is over, the team can go to the field. But it is neither conducive to cleanliness nor health. The dust from cleaning a horse thus defiles

the atmosphere of the stable, settles into the manger and through the feed, and the poor animals are compelled to feed on their own excremented matter.

The horse appreciates cleanliness, and abhors filth in his feed more than any other of the domestic animals. His sense of smell is acute, and he will suffer intense thirst before he will drink from a vessel that has about it an offensive odor. This trait of his nature tells us to be cleanly in the food we provide for him. The carelessness of men and boys who trample over the hay and grain with filthy boots, is an offense to the decency of the horse. If the groom does not care enough for his own cleanliness to take the horse out of the stable to curry and brush, then for the sake of the horse and stable we bespeak it. The cleaning of the farm horse is not generally such, however, as to liberate a great amount of dirt from his skin, and for this reason it may be true that, "there is no dust to hurt," as we once heard a farm hand say.

If the farmer will remember that the skin of his horse performs an office more essential to life and health than even digestion, he will surely see that it needs to be cleaned and freed from the vast accumulation of excremented matter. In nature the horse rolls often and relieves the surface and pores of impacted matter. The presence of the pure soil taken up by rolling even acts as a disinfectant and absorbent of impurities.

Where the horse runs at large, the sunlight, fresh air, and rains, and rolling, disinfect the skin and absorb and remove the refuse of the system. When confined to the stable and at the service of man, the horse depends for these offices on the faithfulness of his groom.

The horse is not properly groomed when the filth and sweat have been scraped off so that the neighbor and passers-by can not see it across the field. Many a farmer simply cleans or curries his team enough to prevent the neighbors making fun of him. It is well that owners of horses like to have them look well, and they clean the coat for appearance sake. Let it be kept in mind, the skin needs to be regularly cleaned for health's sake.

"The share which the skin has in the office of excretion, or throwing off of impurities," Carpenter says, "has probably been generally underrated." The skin and lungs throw off impurities in the relation of eleven to seven. We have, under Ventilation, spoken of the amount of impurities exhaled by the lungs, but we now see that is not so large as the amount thrown off by the skin. Now, any check of this excretion by the skin throws additional labor on the lungs and kidneys, and is likely to produce disorder of their functions. Dr. Fourcault experimented on animals by suppression of perspiration. The evil effects were found to be in proportion to the interference, until by varnishing the animals, "cutaneous asphyxia" followed, and the animals died. The blood can not be kept pure unless the lungs, kidneys, and skin are each in condition to remove promptly the wastes of the system. The great secret of preserving health is in keeping a healthy action of the organs that carry off the wastes of the system.

Now, since the skin is provided with thousands of pores to the square inch, and each pore has its office to perform, we can see that keeping the skin clean, aids in this work so essential to life and health. The most of matter thrown off by the skin is water, but in every one thousand parts there is about ten parts of solid matter, that is offensive to the organs.

If horsemen can not be led to understand the philosophy of cleanliness of the skin and stables as a means of health, it is well that they can be influenced by the pride of appearing well.

The farmers, however, who have so little reason for display in their work, on their farms, must realize the value of cleanliness as a health and wealth promoter.

The Stalls.—For health and comfort, the box stall, 12x16 or larger, is superior, but this method of stabling takes more room than the man of average means can afford. The stall should then be not less than five feet wide. A dealer in horses who had built several stables and handled thousands of horses, gave it as his opinion, that a stall five feet nine inches in the clear is better than wider, since he found horses would get cast

oftener in wider stalls. The length from the manger back to the wall should not be less than fourteen feet; sixteen feet gives room for stall and manger. The stalls should extend back about eight feet and slope toward the manger, so the horse can turn out of the stall more easily. The plan of a post four feet high at end of the stall gives room, but since the writer saw a valuable, good-feeling horse playfully kick up and land his flank on the top of a post and disembowel himself, he has an abhorrence of the low post at the end of the stall partition.

The partition should be so strong as to avoid the danger of breaking down, to entangle or cripple the horse. Bolts are better than nails, for binding the posts and boards together, as they do not loosen and project, to the injury of the horse. The stall partition should not be more than five and a half feet high, and from that to the ceiling rounds can be placed six inches apart, so as to allow free circulation of air, and yet prevent horses biting each other.

The two points of *strength* and *circulation of air* must be kept prominent in building a stable. The poorly, carelessly built stalls are the cause of much discomfort and many a wound to horseflesh.

The Rack, or Manger.—As commonly constructed, the racks and mangers are wasteful of feed, and endanger the sight and health of the horses. If the building is of such size and shape that racks and not mangers must be used, the writer asks that the comfort of the horse be considered, and the racks be perpendicular in front of the horse, and not slope toward him, as is common. In the latter case the hay seed is more likely to fall into the eyes, and the litter fall into mane and foretop, and the position assumed by the horse to pull out the hay is most unnatural.

The writer has both racks and mangers in use, and gives preference to the rack, when the rungs stand perpendicular. They are handy for man and horse, and the horses never can get seeds into eye, mane, or foretop, and can not waste hay; and the great desideratum of all is, it acts as a perfect ventilator, allowing the breathed air to pass upward direct to the

ventilator in the roof. Now, as the racks are purposely made so that more hay than a horse should eat can not be placed before him, the hay is consumed before it becomes defiled by the vapor and gases from the breath and bedding of the animals, while the ventilation of the stall is unobstructed. The reader will see that in the arrangement of stalls and racks and mangers, the floors, doors, and windows of the stable, we need to have in view the *ventilation* of the dwelling of our most noble animal.

Disinfectants.—Since in all inclosed rooms and quarters for animals there are times when the air may become contaminated, we need some means of removing *causes* of infection, and these are called *disinfectants*. They may be divided into *natural* and *artificial*. An antiseptic agent is one which prevents decomposition of animal or vegetable matter. A deodorizer is an agent which destroys hurtful or bad smells that arise from decomposing matter. Ventilation is a mechanical means of disinfecting dwellings, stables, and pens.

Nature has arranged so that sunlight, air, earth, and water are all valuable and ever-present means of correcting impurities generated by animal and vegetable decay.

Sunlight is a disinfectant for our houses and stables that comes in at every opening to annihilate the fungous growth, which is destructive to all animal and vegetable life. Its value is not appreciated by either architect, builder, or farmer. Without light the rose on the lawn or on the cheek of the maiden will not bloom. It is essential to the vigor and growth of animals. Without light and sunshine falling upon it, no domestic animal has ever arrived at a mature growth. The young pig or colt, calf or lamb, will seek the corner of the stall or pen where the ray of sunlight falls. Sunlight facilitates evaporation to a degree that removes so much moisture from things exposed to it that the decomposition is checked. Cold, too, is an antiseptic; yet, in our quarters warm enough for animals, its power is not efficient.

Water may be used mechanically for cleansing, but when absorbed by vegetable matter, it is usually a means for hastening,

rather than retarding, decomposition. Dry earth is unequaled as an absorbent of gases.

Dry Earth an Absorbent and Disinfectant.—The exceeding great value of dry earth as an absorbent of moisture and gases is not generally appreciated. Muck and peat have been used and commended as absorbents for stables and pens by those who have them convenient, but these are few, compared with farmers who have no muck beds or peat bogs within reach. As absorbents of moisture they excel loam or clay, but as absorbents of gases they are not equal to either. Clay possesses, to a greater degree, the property of absorbing and retaining ammonia. A moist soil absorbs more ammonia than a dry one. Now, we see why muck, containing a large per cent of clay-wash, is so grand a disinfectant. The humus in the muck absorbs moisture to a rare degree. This moisture increases the capacity of the clay particles to absorb ammonia. Humus acts chemically and mechanically; so does the clay. Ammonia enters chemically with silica and alumina, and forms double silicates. All soils contain some ingredients which tend to fix the ammonia, and a remarkable feature of it is that, year by year, this soil may be used as a disinfectant, and after drying, it seems to have as great power to appropriate moisture and ammonia as when first used. Compared with straw or sawdust, dry earth is vastly superior as an absorbent, but it has this objection: When wet, it adheres to the animals, which straw and sawdust do not. The perfection of bedding is a layer of dry earth, covered with clean straw.

That the farmer may see how completely he is provided with a ready means of keeping up fertility while protecting his stables against disease, and promoting health, and thrift, and neatness, we give a table to show the property of soils to retain moisture:

One hundred pounds of dry soils, named below, will retain as many pounds of water as the figures opposite indicate:

Quartz sand.....	25	Loam	51
Clay loam.....	40	Garden mold.....	89
Heavy clay.....	61	Humus.....	181

Loam is the kind of soil most easily obtained on the average farm. It will absorb half its own weight of urine, and if then it is sprinkled with a little dry earth, it will give off no odor.

We thus see nature has provided us farmers with a perfect disinfectant, which if we will use constantly and freely, we will keep the air of our stables, pig pens, and privies pure and free from all disease germs and odors, and also retain and return the most valuable fertilizer to our soils. Dry earth is at once an absorbent, deodorizer, disinfectant, and antiseptic.

Artificial Disinfectants.—When any disease prevails, or when an epidemic threatens or epizootic disease approaches, our cellars, dwellings, barns, stables, and pens should all be purified by use of disinfectants. They are cheap and most effective in destroying germs of disease and spores of fungous growth. In the swine-yards and pens, we have nothing better than a liberal use of carbolic acid about the beds and feeding troughs. Copperas water not only cleanses the floors, but purifies the atmosphere. Whitewashing with fresh lime is unequalled as a means of purification and prevention of diseases that so readily develop in an impure atmosphere. These same remedies are all equally efficient in cellars, stables, and pens. By their regular and seasonable use on the farm, the loss by disease would rapidly decrease.

When stables or pens have been occupied by sick animals, the quarters should also before whitewashing be disinfected by smoke of sulphur, that it may penetrate every pore and crack and destroy the hidden germs. Of course the animals must first be removed, as sulphur smoke will destroy animal life. In cases of too great moisture, the free and frequent use of fresh lime is most helpful, as it absorbs many times its own bulk of ammoniacal and other gases.

Fresh Lime is cheap and most effective in reducing the moisture of a cellar or stable, as one bushel of it will absorb 28 pounds of water, and yet its value is not diminished for many purposes. It absorbs carbonic acid, compounds of sulphur, and hastens decomposition and causes "dry putrefaction."

Pure Charcoal, such as tanners use, and not such as comes with ashes from our stoves, is a great absorber of gases. A cubic inch of good charcoal will absorb nine times its volume of oxygen and ninety cubic inches of ammonia. For this reason and its affinity for carbonic acid gas, it is a most valuable preventive and curative on the farm. It is a sure cure for hoven, given to the animal pulverized, an ounce at a time every fifteen minutes until relief comes. Because of its absorbing carbonic acid gas so readily it is invaluable for feeding to pigs and hogs that are highly fed. It is thus both a disinfectant and preventive of disease.

Chloride of Zinc.—This is a liquid, and poisonous. It is usually called Burnett's fluid, after Sir William Burnett. It contains about 35 per cent of the chloride, and it has peculiar value in coagulating albumen, and absorbing ammonia, and sulphuretted hydrogen. One part of the chloride to three hundred parts of water instantly destroys infusorial life, checks decomposition, and its effect in preventing the appearance of animalcules and fungi will be apparent for forty days or more. It has special value as a disinfectant of faecal matter. It has no power as a disinfectant of the atmosphere, hence it is not appreciated by the masses. Diluted with ten times its bulk of water, it may be used to sprinkle floors, to cleanse mangers, racks, and some parts of harness or stable furniture, which may need disinfecting. Blankets and the like should not come in contact with it, as it is too corrosive for that kind of fabrics.

Chloride of Lime.—This is a general disinfectant, and depends mainly for its virtue on the chlorine, yet the alkaline substance has virtue also. This with an addition of muriatic acid disengages hypochlorous acid and makes an excellent aerial disinfectant. A solution of chloride of lime in the proportion of one pound to two gallons of water makes a valuable wash for mangers, racks, woodwork, etc., but they should first be well cleaned with a wash of copperas water.

Chlorine.—Chlorine is given off in small quantity from chloride of lime, when moistened with water or dilute sulphuric acid. It is a powerful disinfectant, and is placed foremost as a

disinfectant. It more surely than any other agent decomposes sulphuretted hydrogen than any other gas, and is an energetic destroyer of any other gas. It checks putridity and the development of animalcules in organic solutions, and will kill them when about four per cent of it is present. It destroys organic matters in the air, and deodorizes by abstracting hydrogen or by oxydization. It is of great value as an antiseptic and destroyer of miasmata and effluvia.

Carbolic Acid.—This is a most potent agent in preventing the appearance of bacteria, and as many of our animal diseases show presence of bacteria, this is a valuable article on the farm. Even in a diluted form carbolic acid will destroy all the lower forms of life, vegetable or animal. Hence its great value as a disinfectant. It possesses remarkable power as an antiseptic. It prevents putrefaction, and arrests fermentation in organic matter, which lends weight to the theory that bacteria is the origin of, or at least always present and essential to, fermentation. Its efficiency as a destroyer of bacteria is noted in the use of it as a preventive of the swine plague, or so-called hog cholera. Its value has been recognized by the commission which investigated hog cholera, and reported to the commissioner of agriculture. It is commonly used now by the most careful breeders of swine. Some use it constantly about the pens and feeding-floors and troughs. One writer says that even the vapor of carbolic acid will destroy the spores of germs of disease which float in an affected atmosphere. It prevents the development of bacteria if used before it has arrived at the glia stage, or massing. Dr. Stetson, of Neponset, Ill., has had remarkable immunity from the disease, though he raises from three hundred to five hundred head of hogs each year, and the disease has raged all around him. The beds, pens, feeding-floors, and water-troughs are never free from the odor of crude carbolic acid. Dr. Detmers, in his report to the department of agriculture, 1880, says he thinks it possible by carbolic acid treatment “to destroy the conditions necessary to formation of glia and the development of swine plague schizophytæ,” by treating about three weeks with regular doses of carbolic acid. With

this, however, he urges keeping the sick and well separated, and all to have pure water, sound feed, and clean quarters.

Disinfectants.—During the prevalence of epidemics farmers are led to buy disinfecting powders and mixtures, and pay ten times as much for them as they ought. We give some formulas that are known to be most efficient and the materials of which can be bought and mixed by the farmer at a great saving. It is said that no one substance acts so effectually by itself as it does in combination.

The “Excelsior Disinfectant” costs about fifteen cents a pound, and is composed of

Copperas (sulphate of iron),	6 pounds.
Common salt,	4 pounds.
Flowers of Sulphur,	2 pounds.

Mix well.

CARBONATE OF LIME is sold, made as follows. It costs about fifty cents a bushel:

Air-slacked Lime,	1 bushel.
Copperas,	1 pound.
Carbolic Acid,	$\frac{1}{2}$ pound.

The following is valuable:

Copperas,	300 parts.
Plaster of Paris,	100 parts.
Carbolic Acid,	2 parts.

Professor Gamgee's liquid disinfectant is also called “Chloralum.” It is not poisonous, and is inodorous. The cost is fifty cents.

Chloride of Aluminum,	$1\frac{1}{2}$ pounds.
Water,	1 gallon.

A cheap and efficient disinfecting wash may be made by mixing

Sulphate Zinc (white vitrol),	1 ounce.
Carbolic Acid,	$\frac{1}{2}$ ounce.
Water,	1 gallon.

A powerful disinfectant.

Sulphate of Iron,	16 ounces.
Chloride of Zinc,	8 ounces.
Water,	1 gallon.

The cost of this will be about one dollar. A pint of it mixed with a gallon of water is strong enough. It is poisonous.

The farmer's standby, however, for the cow-stable, pig-pen, and chicken-house is lime. If every time these are cleaned out a light sprinkling of lime is given, the stables and pens will be dryer and free from odor, and the value of the fertilizers increased. Lime should be used regularly in the cellars and barns. It costs but little, and adds much to the neatness and healthfulness of the home and premises. Lime, copperas, and carbolic acid should be kept and used as regularly as salt on the farm. They are as essential to best stable and herd management, as is soap in the family.

Predisposing Causes of Disease.—Besides the causes spoken of before, we may mention *overcrowding* of animals in winter quarters, or stables, as a prolific cause of disease. We must bear in mind that all of our domestic animals are adapted by nature to live always in the open air. Now, if in our farm management we find it more convenient and more economical to house animals, we must ever be on our guard lest we violate the laws of nature and bring on disease, which is her penalty for violated law.

Fleming, in his great work, gives an instance of an English farmer who tried an experiment of feeding sheep a certain variety of turnip. They became ill and began dying. A veterinary surgeon was sent for and he recommended merely *better* ventilation. More air was allowed each sheep, and the disease disappeared, though the same feed continued. The horses on a vessel imperfectly ventilated during a storm, with the hatches closed, were attacked with glanders and farcy.

Overcrowding may cause sudden death, or induce epizootic and contagious diseases. French authority gives a case where forty-two head of cattle were infected by the emanations from accumulated manure.

Labor and Fatigue.—That a certain amount of exertion is good for man and beast, we have claimed, but it is equally clear that a sufficient amount of rest and suitable food must be allowed to repair the loss of tissue. Long repose, as in winter,

when no farm work is done, and a superabundance of food is given, tends to disorders and derangements of the functions.

Over-work and fatigue on insufficient or improper food results in debility, an impoverished state of blood, and general feebleness, which invite disease. There are many forms of disease that come with such conditions. The contagious foot-rot of sheep was unknown in France, Italy, and Germany, before the introduction of merino sheep driven from Spain. Now, as the disease was unknown in Spain, it was concluded that the malady was produced by the fatigue incident to the long journeys. Some most eminent veterinarians of Russia have shown that the rinderpest or cattle plague breaks out among the droves of cattle, which are driven great distances and badly fed, and suffer for water, and with dust and heat on the long journeys. Cattle which had left Russia or Hungary in perfect health, were only attacked by the disease when they had been a long time on the way or after arrival in Germany or France. Such cattle not only developed the deadly malady in their own systems, but communicated it to the German and French animals which came in contact with them. These examples illustrate how readily disease and epidemics or epizootics may be generated and spread.

Now, as we have rapidly increasing herds all over the country, and as farmers everywhere are interested in the raising of stock, this question of origin and prevention of endemic diseases is of vital importance.

Feeding.—As to the nature and values of grains and fodders, the reader will find much of profit in the chapters on this subject. But when we find men do not know even how to feed themselves to keep in good condition, it is evident the problem of feeding animals has not been solved. We find the temperament and habits of the farmer have more to do with his success as a handler of stock than his accurate knowledge of the feeding values and constituents of food.

The farmer who is nervous, excitable, and always in a rush and splutter, never has horses in good condition. The animal needs to be free from all excitement when feeding. It needs to

be at rest and contented. The digestion is influenced so quickly by nervous conditions, that if we would feed so as to secure best results therefrom, we must arrange hours of work and methods of feeding, so the animals can contentedly and quietly take their rations at regular times.

The rushing, tearing farmer has not time to allow his team to rest before eating. The animal comes to the water-trough heated, and weary, and excited, and mechanically and greedily fills itself with water, and in the same way bolts its feed, in an excited, exhausted condition. Animals so fed and watered are never in good condition. We have seen this class of farmers feeding ten to fifteen ears of corn at a feed, and stuffing the mangers three times a day with hay and fodder, and complaining that their horses never get fat, and never look right. The neighbor's team, on the other hand, is plump, hair lively, and the horses always ready for work and need no urging with whip or yells to get them to do their work. *How* to feed, is as important as *what* to feed.

How to Feed.—The burden of writers is usually on the analysis of feed; how much it takes to keep up heat and repairs of fiber and give a surplus of strength or force. All of which are most important. Yet with all this, unless the farmer loves his team and can in his work and grooming and general handling of them be thoughtful of their comfort, he will not have them come to the stable in condition to feed.

When our teams are weary from long-continued work, they should be allowed time to rest before feed is given. This is necessary to secure proper digestion. It is not the amount *eaten*, but the amount *digested* and *assimilated*, that repairs waste of tissue and gives strength.

If the feed and drink are not given regularly, and when the animal is in condition to masticate and digest the food, the drink and feed, so far from being a benefit, may prove an injury. Here we are met with the cause of indigestion, followed by colic, and then by inflammation of the bowels, two ills which destroy more farm horses than all others combined. Along with these come founder.

After securing regular feeding as to time and amount, we should notice that the hours of feeding and drinking are not too far apart. The practice of feeding at four o'clock in the morning, then at twelve, and not again until dark, which means in the season when tending crops until eight o'clock, places so heavy a tax on the vitality of the farm horses that they are fit subjects for any ailment, while the farmer who thus feeds considers himself fortunate if his teams pull through the season without sickness or death.

The stomach of the horse is small, and nature has designed it for short periods between rations. The horse in a twelve-months can do more work and at less risk from disease if the times between feeding be shortened. The rule on some of the best regulated farms is to feed at five, at twelve, and at six in the evening. On other farms the teams are fed at 4, 11.30, and 7.30. Now, the strain on the farm team is cruelly severe. We need a reform. No one schedule of times will suit all, but economy and reason and kindness all demand a change. Our farm teams suffer greatly by these long intervals between feed and water, especially as the work is severe and taxing.

What to Feed.—While horses are at hard work for so many hours, it is clear that the feed must be very nourishing. It is force and not fat we need now. Hence oats is better than corn alone, but we find that clean oats and sound corn, half and half, give better results than either fed alone. All the clean timothy hay he will eat may be given to the farm horse when worked many hours, but as a usual thing the farm horse gets too much hay. He feels better, does better, with less hay and some grain, even when not at work, and this is especially true in winter. Timothy hay is considered best, not because it contains more elements of nutrition than clover or hungarian, or orchard grass, but because it is more easily cured and has less dust or mold in it. If clover hay can be had free from dust, or can be cut and mixed damp with ground feed, it will be found equal to any other feed as a producer of strength and fiber.

If the horses can not have green grass once or twice a week, they should have a bran mash instead. But as hired help will

often leave enough mash in the tub or manger to ferment, we have found that dry bran, mixed with the oats and corn, gives excellent results and protects against dangers that come from feeding stale or musty mash. The horse, of all animals, needs pure, sweet, sound feed, and can not long "stomach" filthy treatment of his supplies. Some men with stomachs like an ostrich or a pig, have no sympathy with an animal that can not eat heartily of anything given him. Poor hay or damaged grain should never be given to horses; musty, dusty hay endangers the wind, while damaged grain induces inflammation of the bowels.

The work horse can not keep up strength and flesh on insufficient or poor feed any more than the engineer can keep up a requisite head of steam on improper or insufficient fuel, nor the horse or engine do its work if the supply of fuel or feed be not given regularly and as needed. Neither too much nor too little is the golden mean which gives health and vigor.

Economy in Feeding.—The waste about the stables of the farmer is astonishing to the careful livery man, who has to buy his feed, and whose business demands that his horses shall daily be in condition for work and for resisting disease. Farmers as a general thing feed too much, are not sufficiently careful as to the quality, and do not regulate the amount of feed to the demands of the system, which is influenced by labor and rest, as well as by change of season or temperature. In the winter we can keep our horses and colts more cheaply by the use of a little grain with a moderate allowance of hay than on hay alone.

A study of the feeding values of hay and clean straw, of corn, oats, bran, and oil-cake meal, will show, as have our own experience, that by cutting straw, or clover hay, or timothy, and adding enough of bran, oil-meal, and corn-meal to make the ration complete, we can keep our horses and cattle far more cheaply and in better condition than when we have trusted to the standard feed of the West—corn and hay, or even oats and hay or fodder. Laziness and want of knowledge of the facts are against economy and the best sanitary and hygienic treatment of animals on the farm. We are met with the answer, "O, it

is too much trouble to cut and grind feed—I can keep my horses fat on corn and hay.” So you can. So can we fatten a steer; but that does not argue highest health or activity or strength.

While we name ground feed as more economical, we would add that it must always be fed with cut hay or straw, to make it most wholesome and economical. We feed too much bulky, dry feed to our horses in winter. They need to drink great quantities of cold water when fed only dry feed. We can make the feed more palatable, more digestible, by dampening the hay and corn, or cut straw and mill-feed. In feeding oats it is better to use a sieve to wash them, as it removes dust and gravel, grit, or broken nails or wires, that may be found in the oats. Clover hay, too, becomes a most valuable and economical feed when run through the cutting-box and dampened, and mixed with ground feed.

Oat-straw costs only about one-fifth or one-tenth as much in the West as good timothy hay. We have found that horses and colts can be kept in prime condition by using oat-straw with grain and ground feed. The peculiar value of hay and straw lies not in the elements of nourishment contained in them being different from those in grain, but in the bulk and dissemination of these elements. The digestion of rich, concentrated feed is not so prompt or complete as that of more bulky feed, and is more liable to ferment and cause indigestion, to be followed by inflammation.

The careful, industrious, and observing farmer will not follow in the old easy-going ways of hastily feeding just what is handiest. The feed of our animals is our heavy expense, and by its wise and economical use we are to secure our profits and their highest comfort and health.

The Value of Bulky Food.—E. W. Stewart, in his most valuable work on “Feeding Animals,” has more successfully illustrated the value of bulky food, and how to use it, than any other experimenter and writer. English farmers have more carefully studied this question of economy in feeding than have our American farmers, simply because their margins are smaller.

It is true that the horse and the pig can not do as well on fodder and hay as the ox, because their stomachs are smaller, and their teeth are made for better grinding grain than are those of the ox. Nevertheless it is true that either the pig or the horse, fed on grain alone, soon shows derangement of digestion, which has been corrected by simply mixing with the concentrated food a distender, like hay, clover, or straw. Bean meal is a favorite feed for horses among English horsemen, but it needs the husk of the oat, or the fiber of hay or straw mingled with it, to facilitate the ready action of the gastric juices on the mass in the stomach. For the same reason corn-meal alone is not a safe or economical feed for horses, pigs, or cattle.

Nor is it enough that, after a feed of meal, long hay or fodder be given. The meal has been moistened and packed in the stomach, and has not been masticated and mixed with saliva, as when mixed with rough feed; it has to be more thoroughly masticated, which incorporates saliva and combines the fibrous and concentrated feed so there is prompt and ready action of the gastric juices on the entire mass in the stomach, and not merely on the outside, as when the meal is in a doughy mass.

The principle of this incorporation of bulky with concentrated feed is well illustrated by an experiment made by Stewart, in feeding pea-meal to horses at heavy work. He fed "sixteen pounds of pea-meal mixed with one bushel of cut hay, the hay being moistened so that the pea-meal would adhere to the hay, and all be eaten together. Long hay was given in addition, making about twelve pounds of hay. Four horses were thus fed for four months, performing full daily labor. The average weight of the horses at the beginning of the experiment was 1,050 pounds, and at the end 1,065 pounds." The condition and health of the horses were carefully watched, and found satisfactory. There was no feverish condition or indication of any disturbance of the digestive functions. The appetite remained very uniform, and there was every appearance of contentment.

This experiment showed that the feed was well applied for forming muscle. It also showed the valuable effect of mixing

concentrated feed with hay to give porosity to the bulk in the stomach. The value of this point is made more forcible by the fact that a neighbor did not think it made any difference whether the pea-meal was mixed with cut hay, or fed separately, and the hay given to his horses uncut. He fed four horses sixteen pounds of pea-meal to each horse in three feeds, with long hay, unmixed. "Within six weeks two of his horses had severe attacks of colic, and both of the others had to be treated for constipation." He was prevailed upon by Mr. Stewart "to feed the pea-meal mixed with one bushel of cut hay, and in a few weeks his horses were in apparent health, and able to do efficient work." The effect was so favorable that he continued to feed meal—whether of peas, corn, or other grain—mixed with cut hay, and said he never had a case of colic afterwards.

Feeding Corn-meal.—Now, as digestion and assimilation of the largest per cent of food eaten is the point to be gained in the most economical use of feed, and as the animal that grinds and masticates the grain most thoroughly thrives best, farmers have been led to feed ground grain more than formerly. But the verdict of the majority of farmers is, "It do n't pay to grind feed." They affirm that the animals are liable to dullness and colic when fed a full feed of meal.

On this subject Mr. Stewart records his experience of thirty years in feeding work-horses corn-meal. He has it ground as fine as burr-stones will make it. He *always* mixes it with cut hay or straw before feeding it, and when so mixed has never had colic among his horses. He gives the following dearly bought experience. An acquaintance called on his return from a pleasant drive of a hundred miles west, in June. Putting his fine horse into the stable, he was proceeding to give his horse a good, round measure of fine corn-meal, when a little seven-year-old son of Mr. S. warned him that it would make his horse sick if he did not mix it with cut hay. He replied, "I will risk it." An hour later he started to drive eight miles, and was scarcely able to get his horse that distance. The horse died before morning. The owner, speaking of it afterwards, said, "The boy

warned me, but I was not humble enough to learn wisdom from babes, and I lost my horse." He consoled himself that this sad experience would save other horses from like ailments.

The above experience and incident show that our *manner* of feeding is fully as important as *what* we fed. Corn is the handy and ever-present feed in the West, but it is deficient in muscle-forming elements, and too rich in heat-formers to be used as the only grain feed for horses and even pigs.

A more wholesome and more economical ration is made by mixing equal weight of oats and corn, and having them ground together, and mixing sixteen pounds of this meal with a bushel of cut hay or straw. We have found this mixture better than corn or oats and long hay, and more economical.

Mr. Stewart says: "A better ration still is nine hundred and fifty pounds of oats, nine hundred and fifty pounds of corn, and one hundred pounds of flaxseed, all ground together." This addition of flaxseed improves the ration in albumenoids and oil. When corn is sixty cents and oats thirty cents per bushel, this mixture insures a saving of about thirty-three per cent, and is far more healthful than corn and hay.

Accumulated Experience.—These questions, of what to feed, and how to feed, are of such vital importance in securing health for our horses, that we do well to consider the methods of those who have greatest interest in the problems of economy and health, and most at stake in the solution of them. The American Institute Farmer's Club appointed a committee to make a thorough examination of the method of feeding in the omnibus and railroad stables of New York City. The number of horses kept is great, and the experience of the superintendents, backed up by intelligence and fitness for their work, makes the result of this investigation valuable. We give the substance of their report which bears on our subject. It is the aim of the several companies to get all the work out of their teams possible, consistent with health.

The stage-horses consumed more than the railroad horses, and the livery horses less than either. The stage-horses are fed on cut hay and corn-meal, wet and mixed in the proportion

of one pound of hay to two pounds of meal, a ratio adopted rather for mechanical than physiological reasons, as this is all the meal that will adhere to the hay. The New York Consolidated Stage Company uses a very small quantity of salt. They think much salt causes horses to urinate too freely. They find the horses do not eat so much when worked too hard. The large horses eat more than the small ones, and are sooner used up by wear, their feet and shoulders giving out. Horses do not keep as fat on oats alone, if at hard labor, as on corn-meal, or a mixture of corn-meal and oats. A mixture of half oats and half corn is preferred when oats are not too expensive. The hay is all cut, mixed with meal, and fed moist. Yellow Jersey corn is considered best.

In cold weather the horses are watered four times a day in the stables, and not at all on the road. In warm weather, four times a day in the stables, and are allowed a sip on the road at middle of the route. The horses are not allowed to drink when warm, as it founders them.

In warm weather a bed of sawdust is prepared for horses to roll in. They eat more in cold weather than in warm. The difference, however, is not exactly known. In the worst of traveling the three hundred and thirty-five horses of this company eat forty-five thousand pounds of meal a week. In good weather they eat forty thousands pounds of meal, or one-ninth less.

Of seven stage lines, using one thousand one hundred and eleven horses, we find the average of travel per day was sixteen and a half miles. On an average the horses were fed daily twenty and six-seventh pounds of cut hay and thirteen and a half pounds of corn-meal and two ounces of salt per day.

From this report, which we have greatly condensed, it appears: 1. That horses, even at hard work, can be kept in good condition on cut hay and corn-meal. Stewart has thoroughly proven by his own experience, that when he used cut clover, hay, and corn-meal the horses kept in better condition than when timothy hay was used. 2. A mixture of oats benefited the horses, but increased the expense of keep. Corn-meal keeps horses fat better

than oats. 3. Rye bran, fed with new corn, prevented scouring. 4. Ten pounds of hay per day is sufficient for a work-horse.

The Cost of Keep.—We farmers find it difficult to consider any question without asking about the cost. We may see, from the recorded experience of twenty-three English firms, that the average cost of keeping a horse one week was \$1.87. The highest cost given was \$2.76, in which case there was fed 70 pounds bruised oats, 28 pounds bruised beans, 243 pounds pulped roots, 42 pounds barley, and straw *ad lib.* The lowest cost, \$1.14, was made in the use of 63 pounds oats, 42 pounds roots, and 196 pounds straw. A mixture of 56 pounds cut hay, 56 pounds cut straw, 56 pounds ground oats, and 56 pounds pulped potatoes, cost \$1.56. In the case where 56 pounds hay, 42 pounds oats, 12 pounds bran, and straw *ad lib.*, were used, the cost was \$1.32. In all these cases the horses were reported to have worked regularly and to have done well. The cost of keep for the year was \$97.24.

In my own experience, when the work-horses of the farm are fed corn and hay in winter, and oats, corn, and hay in summer, the cost of keep averages \$72.00. Where the hay is cut and the oats and corn ground, there is a saving, and the cost is reduced about one-fourth. The latter plan of feeding is not only less expensive, but more conducive to health. Yet, when the farmer is pressed with work, and the corn and oats and hay are at hand, it is less work to feed them unground, uncut, and dry.

Drink.—The amount of water taken daily will depend on the size of the horse, the work engaged in, the weather, and feed given. The animal, like the vegetables he feeds on, in a state of nature, is composed of about three-fourths water by weight. If the food consumed is green, undried, there will be less water drank to meet the demands of the system. When the grasses and grains have become ripe and dried, it is plain that the animals will need more water to drink. By respiration, the animal exhales moisture with every breath. The process of depuration can not be carried on without moisture; every pore of the skin and mucous membrane, in the ever-acting process of depuration, or throwing off impurities of the system, carries

off particles of moisture. This moisture is rapidly absorbed from the surface by a dry, heated atmosphere, and when the exercise is vigorous the horse sweats freely.

Dr. Southard Smith has given some experiments, showing that workmen at the Phoenix Gas Works lost by perspiration, while drawing and charging retorts with a temperature of 90 degrees, during forty-five minutes labor, on an average, per man, 3 pounds 6 ounces. Now, this will help to estimate the amount of water thrown off from the body of a horse, weighing ten times that of the workmen. It will be at times as high as 30 pounds per hour. But as the amount thrown off by perspiration is greatest after drinking, the average amount thrown off during the period from the morning to noon drink, must be near 10 pounds per hour in warmest weather. Now, as the functions of digestion and respiration can not be carried on without the presence of a normal supply of moisture, it impresses us with the importance of furnishing the horse with a regular and abundant supply of water, and that free from all impurities. Anything impure in the water has to be eliminated by respiration or through the kidneys. Organic or vegetable matter that ferments and decays speedily in the presence of moisture and warmth are detrimental to health.

Pure Water.—The purity of water, as well as the regularity and abundance of it, can not safely be neglected. There is an impression that rain water is more pure than spring or well water, but unless the rain water has been carefully filtered, the average spring water is purer. Horses accustomed to either can not safely be changed from one to the other without some derangement of digestion or urination.

The veterinary records show many instances where whole stables have been disordered by the water supply containing organic impurities. In the season when the weather is dry and hot, and the evaporation greatest, animals demand the greatest amount of water. It is during this period, too, the supply is most likely to become impure. The wells and cisterns get low and the impurities abound near the bottom. Ponds and lakes, too, in the hot season are liable to become low, stagnant, and dangerous sources of disease.

So important is pure water in the animal economy that the farmer can not safely neglect to provide against disaster to his stables and herds, ever ready to burst on him when the water supply becomes low and impure. The average horse will consume from four to twelve gallons of water per day, and neglect to provide it pure and abundant entails on him great suffering, and consequent loss to the owner.

Grooming for Health.—Because of the importance of the function of respiration, nature has made the animal so if the process is impeded on the outside by closing of the pores, by changes of weather, or by filth, then the mucous membrane that lines the throat and lungs and stomach and intestines must do the work. Nutrition may stop by the food being withheld for a long time, and the animal survive, but we have before shown that depuration or the throwing off of impurities must go on or death soon follows. If breathing can not go on by the way of the nostrils it must go by way of the mouth; so if respiration can not proceed by way of the outer pores in the skin, then it must go by the inner pores of the mucous membrane. So nature has provided two ways of doing that which must be done or the animal speedily dies. The mucous membrane is the relief-pump to act when the pores of the skin are impeded.

It is difficult to have the unintelligent horseman appreciate the importance of cleanliness of the coat of all animals, and to have the masses appreciate the healthful influences of bathing and cleanly habits. Every part of the skin of animals exudes either sensible or insensible perspiration, which is ever unloading a supply of waste matter, which, in the case of the horse, can best be removed by the brush or wisp of straw. If not removed the internal organs are more liable to congestion. The groom has the incentive to clean well and often his favorite animal because he has learned that the coat looks better. Nature rewards us by supplying at the root of the hair a finer oil than chemistry has yet compounded. It is ready to dress every hair of the animal as soon as by cleanliness and friction the obstructions are removed from the pores. The careful and observing horseman has learned that it is best to clean his

horse after his day's work. The cleaning, then, is better than in the morning, if either is to be neglected.

The reader sees the philosophy of this keeping the skin clean, that there may be a healthy action of the tens of thousands of pores that may be called the sewers of the animal system. If the mouth of the sewer becomes stopped, disease, pestilence, and death sooner or later must follow. We have not the space here to tell how to groom a horse. Every stable-boy knows; and every farmer should see to it that his horses have well-cleaned coats if he would see them healthy and strong to labor. There is an old saying that "grooming is half the feed." It has philosophy and truth in it. Johnson, in his *Elements of Chemistry*, says even pigs need their coats cleaned to induce greatest thrift. "Six pigs were put in a pen together for seven weeks. Three were currycombed and cared for and the other three left uncleaned. The former three consumed five bushels of peas less and had gained two stones and four pounds more than the uncurried three." Proper cleaning of the horse, cow, steer, and pig tends to health and profit.

Condition Powders.—There are various vile and deceptive combinations offered to stable-men and farmers under the name of condition powders. They are, in the hands of the ignorant groom, as much to be dreaded as the soothing-syrup for babes in the hands of an ignorant nurse. They are both sources of danger and suffering. We are told by the stable-boys the horse is "out of condition," and he needs some powders. Such drugs are in the stable; they are administered at random, without counsel or advice of owner or veterinary. In this way they are an abomination.

"Out of condition" is a term applied to very different states of the system. The more common is where the horse has been liberally fed and is fat. He becomes capricious about his feed, his appetite varies, his eye lacks fire, he seems dull. The bowels are bound, dung too dry, and there is a general lack of snap or tone. The trouble is plethora. He has had more rich feed and less exercise and air than is prudent. No medicine whatever is needed. The diet should be changed to a more

laxative and mild one. A few days at grass will correct all, or, if that be not possible, sweet bran-mashes, gentle exercise, and good grooming will give relief.

The other case of "out of condition" may arise from over-work and under-feeding. Here rest and grass, or rest and richer feed with a bran-mash twice a week will do more than "condition powders." The trouble may be a form of indigestion. This will not be relieved by "condition powders." Let the secretory organs be aided by good grooming, the kidneys aroused by a mash with niter or saltpeter in it in small quantity, followed by regular feeding of easily digested food.

It is a good rule when the farm-horse is sick and you don't know what to do, then do nothing unless you turn him into a comfortable grass-lot to rest. There are ten horses killed to one cured by heavy dosing by blunderers who can not diagnose a case, yet keep physicking, hoping to find something that will reach the case. Better, far, give nature a chance and stop the groping in the dark. If we do not know enough to add to the comfort of the horse, let us be kind enough not to add to his troubles. Tonics may be of great value where properly administered. They should not be often repeated. Such a course will surely be followed by obstinate dyspeptic troubles, which are forerunners of declining health.

Hospital.—Every farm should have some place where the sick of every flock or herd can be made comfortable and treated apart from the other animals. This is especially important in cases of contagion. The barn is not complete without a roomy box-stall, where a sick horse can find comfort. It should be well-lighted, roomy, well-ventilated, cool in summer and warm in winter. Such a place will find use many times in the year where much stock is kept. The mares at foaling-time, cows at calving-time, will find protection and comfort here for themselves and helpless young. In this age of hog-cholera the swine-breeder can not safely allow a sick pig to remain in his herd. It is a wise and safe rule to remove at once from the herd or litter any pig that is sick. The facility with which diseases spread among swine makes this precaution imperative.

The Horse-blanket.—The horse-blanket is a thing of comfort that, wisely used, will pay to keep. Every horse needs one at times, as surely as the owner at times needs an extra coat. The farm team used for slow work does not in general need to be blanketed when standing, but when driven from home, and having to stand in a cold wind, prudence and kindness demand that, while standing, they be blanketed. The road horse, that is warmed up by a few miles drive, is in condition to take severe cold, unless promptly blanketed as soon as he comes to rest. There should be especial care in the spring time, when the winds are chilly and damp, and the horses are shedding their coats. The system is not then in condition to resist such a shock as comes with cooling suddenly in a cold wind. A blanket is a necessity for every horse that is driven off of a walk, or has to stand after severe labor, in a cold wind. It is cruelty and wanton carelessness to drive a horse until heated, and then hitch him to a post to shiver in the cold. The old theory, that exposure makes animals hardy, is merely an apology for carelessness, cruelty, and meanness.

CHAPTER VI.

THE ASS AND MULE.

THE Ass.—The ass is the humblest member of the horse family, and is designated *equus asinus*. He was probably the first subjugated by man; is the most patient, sure-footed, and hardy. He was well known to the ancient Hebrews, as we know from the four Hebrew words used in speaking of the ass. From these four words it has been erroneously asserted that there are “four different races of the ass family.”

Chamor is the Hebrew general name for the male ass, tame or wild. Like the Spanish word, *burro*, it signifies reddish in color. '*Air* signifies a young male ass. *Arod* is the wild ass mentioned by Job. *Pere* is the wild ass of Asia, formerly found in Syria, and still found in Arabia and Persia.

From the time Abraham went down into Egypt, and Pharaoh took his wife, Sarah, the mention of asses as beasts of burden is constant and uninterrupted to the end of sacred history, while the horse was never spoken of until after several generations, when Joseph gave the Egyptians corn “in exchange for horses, and for flocks, and for the cattle of the herds, and for the asses.” Xenophon describes the chase of the wild asses by the soldiers of the army of Cyrus. Martial calls it the *pulcher onager*—the beautiful wild ass. Oppian describes its beauty, fleetness, and untameableness. The fleetness of the wild ass was so remarkable that the Persian monarchs took delight in their chase. Nadir Shah considered the running down of one with his grey-hound as great a feat as winning a battle. Their flesh was esteemed as the most exquisite of venison.

It is not likely these were the progenitors of the ass of Spain and Malta, since speed is not a thing to degenerate so

greatly by domestication. The tamed horse, with his rider on his back, can run down his wild congener, while the tamed ass only excels his untamed fellow in docility and patience and endurance under hardship. For ages he has been the beast of burden, and the companion of poverty. Prior to that, and before the horse became the favorite with kings and potentates for show and parade, the ass had been esteemed and bred for that purpose. Deborah, in her song, apostrophizes the great and powerful of the land as "Ye that ride on white asses."

Colonel Smith, in his study of the equine races, found, near Bassorah, a breed of white asses remarkable for their excellence, and as ancient as the time of the kings of Judah. In "Blaine's Encyclopedia of Rural Sports," we are informed that the asses in Guinea are large, and excel even the native horses in shape. The same authority says, "The asses of Arabia are perhaps the handsomest animals in the world. Their coat is smooth and clean; they carry the head elevated; have fine, well-formed legs, which they throw out gracefully in walking and galloping. In Persia, also, they are well formed, some being even stately, and much used in draught and carrying burdens, while others are light proportioned and used for the saddle by persons of quality, frequently fetching the large sum of four hundred livres; and, being taught a kind of easy, ambling pace, are richly caparisoned and used only by the rich and luxurious nobles."

There are many passages of Scripture which show that the princes and rulers, of Israel especially, rode on asses. Jaer, of Gilead, had thirty sons, who rode on as many asses, and commanded in thirty cities. It is not probable that our Savior's riding into Jerusalem was made on the ass's colt as an emblem of humility; but he mounted on the animal that from time immemorial had been used by the kings of the Jews, and his action may as well be construed into the triumphal entry of Israel's greatest King into the capital city.

The superstition that the mark across the shoulders and along the back of the ass that the Savior rode, has appeared ever since on asses and their descendants, the mule, does not

harmonize with the fact that all its ancestors, tame and wild, with its kinsmen, the quagga and zebra, have like markings.

The usual color of the ass is gray, mouse-color, or black; but bays, duns, and chestnuts have been found. The dental system of the ass is similar to that of the horse, and his age can be recognized by the growth of the teeth.

At two years, the male ass is capable of propagating his kind. The female breeds even younger. The potency of the ass is remarkable, which, on the laws of breeding recognized, may explain the fact that the offspring of the ass and mare is, in organization, temper, style, appearance, and quality, more like the *equus asinus* than the *equus caballus*. The mule is an ass modified by the horse, rather than a horse modified by the ass.

The ass and his progeny, the mule, are capable, under kind treatment, of great improvement in form, style, size, and quality. He has no equal in patience and power to endure labor and hardship. He has qualities which will well repay all efforts to improve by careful selection and judicious, liberal keep. In Spain, Italy, and Malta, the ass has been more carefully bred, and there are found the largest and best formed of the race. They are susceptible to improvement, and can be bred for the draft or saddle. Darwin states that in Syria there are four distinct breeds: "A light and graceful animal, with agreeable gait, used by ladies; an Arab breed, reserved exclusively for the saddle; a stouter animal, used for plowing and various purposes, and the large Damascus breed, with peculiarly long body and ears."

In the blue-grass regions of Kentucky, Illinois, and Missouri, where mule breeding has been pursued for years, asses have been bred for size and strength, until in this congenial climate and on liberal feed they are found to grow to be sixteen hands high, although sired by Spanish jacks that were not over fourteen hands high. We know of no better illustration in all the range of improved animals to show what can be done by the intelligent breeder of live-stock who will select and feed for a given end. The Poitou ass is another illustration of what liberality of feed, adaptability of soil and climate, coupled with

judicious breeding for a specific purpose, may do in improving even an ass.

Though the ass has for centuries been subjected to hardships, and since the general use of the horse by the wealthier classes has relegated the ass to the conditions of poverty, nevertheless the vigor and stamina of the race are so remarkable that its quick response to careful breeding and liberal feed, has given Poitou a race of jacks that often exceed sixteen hands. The feed, climate, soil, and handling, which have produced the noble French draft-horse, have there given like development to the jacks of Poitou.

The Mule.—The mule is the offspring of the mare served by an ass. They are as ancient as written history, and have been noted for their longevity, sure-footedness, power to endure hardships, patience under abuse, and ability to resist heat. Like hybrids generally, they do not reproduce their kind. Occasionally a mule has produced foals, but this is exceedingly rare.

They were prized by the Romans, and according to Pliny great attention was given to breeding mules. Quintius Axius, a Roman Senator, paid 400,000 sesterces, more than \$13,000, for a jack to use in his stud. When male asses brought such sums of money, it is not strange that well-bred and well-formed female asses should be prized at prices which at this day would seem fabulous. The prices then paid, in comparison with money values of this day, exceed the prices now paid for our best-bred trotting stallions. They were so steady and reliable and had so great endurance, that mules of the fifth century before Christ were used in the chariot races of the seventieth Olympiad.

The Mule in America.—General Washington has the honor of being the first to appreciate the mule as an animal suited to the plantation work of the Southern States. He is the first successful breeder of mules in the United States. From the beginning made by him on his farm in Virginia, mules have been introduced into every State in the Union, until the census of 1880 shows 1,812,808 mules and asses, against 10,357,488 horses in use.

The Southern planters found the mules a great blessing, because they are longer lived, less liable to disease or injury than the horse in the hands of careless and ignorant drivers. They also live on rougher feed, and endure heat better. They frighten less, and when they run away they seldom do themselves injury. North of forty degrees they are much less used, and in the New England States and North-west they are rarely found among the farmers. The jack is impatient of cold, and his offspring can not endure the cold as well as the horse.

Mr. Custis says that the king of Spain presented Washington with a jack from his royal stud in 1787. The animal was large, ill-shapen, near sixteen hands high, with a very large head and clumsy limbs, and to all appearance little calculated for active service. He was of a gray color, probably not young when imported, and died at Mount Vernon, but little valued for his mules, which were unwieldy and dull. He was named Royal Gift. With him came a jennet, which was bred to a jack called Knight of Malta, a present from General Lafayette. He was of moderate size, clean limbed, of great activity, with the fire and ferocity of a tiger. He was a dark brown, very nearly black, with belly and muzzle white. He lived to a great age, and died about 1802 or 1803, at New Kent. His mules were active, spirited, and serviceable, and from stout mares attained considerable size.

He got from the Spanish jennet Washington's favorite jack, named Compound. This cross of the Spanish and Maltese blood was the beginning of success in mule breeding at Mount Vernon. Compound was a very superior animal, very long bodied, well set, with all the qualities of the Knight, and the weight of the Spanish. His mules were active and well-formed. Bred to the best coach-mares, his get brought extraordinary prices. The experience of Washington has been that of all his successors in breeding mules, that the value of the mule bears a just proportion to that of the mare. In accordance with this view, Washington bred his best pair of coach-mares to the Knight of Malta and to Compound, and produced such superb mules that the country was aroused to breed some of the same sort.

The principal mule-market in the United States is St. Louis, where they are brought from Missouri, Kentucky, Tennessee, and Illinois, and shipped to all parts of the Southern States, to Cuba, and recently a European trade has sprung up.

Breeding and Breaking Mules.—In breeding mules the same laws govern that lead to success in breeding horses. Attention must be had to the use for which they are intended. Pack-mules for use on mountains and rough lands, are bred from fine, active, compact Spanish jacks. These mules are agile and sure-footed. The plantation mules must be of medium size. They are bred from ordinary mares by good jacks of good size. Team and truck-mules, sought for city and farm use in the middle States, come from large, roomy mares and the largest and strongest jacks. They are liberally fed and ready to sell at three years old, when a smooth, large, well-matched pair will sell for \$300 to \$600.

The mares and foals are to be handled as described in our chapter on brood-mares and colts. The mule responds to kind treatment and liberal feed as promptly as a young horse. At two years old the mule may be broken to work. Care should be taken at first, not to frighten them with the harness. They will not likely injure themselves by strains or over-work, as will a spirited young horse, but their work should be light until they are four years old, when they may safely be put to full work. Their very meek appearance and patience under abuse, seem to lead rough men to treat them cruelly. The mule is not naturally vicious, yet he never forgets an injury, and when subjected to a long course of ill-usage is likely to resent abuse. He is resentful of injury, yet no other animal excels him in faithfulness to a kind master.

It is found that in breeding mules there is constant care needed to guard against a sluggish, heavy nature. The best mules come from high-bred mares and spirited jacks which are from fifteen and a half to sixteen hands high. The better the mare the better the mule, is a common belief among breeders.

Experience in Breeding.—E. F. Spencer, of Kentucky, has had large experience in breeding mules, and we give the

substance of his remarks on this subject. During the breeding season, beginning here in March, the jack should have a lot large enough to give him grass during the night, but in the day-time he should be kept in a tight stable. No horse-stock should be allowed to come near the fence, lest the jack become fretful and vicious, and then will bite the horses and fret so as to become thin in flesh and unserviceable.

If permitted to run in the lot during the day, feed three times a day four to six ears of sound corn, two bundles of sheaf-oats cut up to the band. He commends this as a better plan. If the breeder has no grass-lot, he advises a feed composed of oats cut up and corn-meal ground fine; mix, and put in a little salt. Feed little at first to avoid founder and colic. He may go to one or two mares at two years of age, but must not be bred to jennets before he has served at least a dozen mares. He can serve one mare in the morning and one in the evening, and should be limited to forty or sixty at most, the first year.

During the season the jack must be securely haltered through the day, for, though seemingly docile, he has known them to seize the groom with bull-dog ferocity. Give him no chance to do mischief. "The application of a good hickory will soon cure his viciousness."

A jennet will carry her foal twelve to thirteen months. The young foals are more likely to be smothered than horse-foals, and the owner should be present when the jennet foals. The young, healthy jack will get his best foals the first season. If the jack is fifteen to fifteen and one half hands high, and has size by inheritance, one can, from mares of good size, confidently expect good-sized mules. The well-bred mule, if well cared for, will grow six inches the first year and three the second, and will have attained his full height at two years if well kept. If poorly fed he will not mature until three years old. The stunting business does not pay, as it costs an extra year's keep.

Breaking and Managing Mules.—The nature of the mule is not so different from that of its mother as to justify the common view, that breaking a mule is simply force work. The mule and even the ass are susceptible to training, and are more

easily taught by kind management than by blows and rough usage. Students of natural history inform us that the ass and mule are like the elephant in their remembering and resenting an injury.

Mules are so patient, and so much less nervous than are horses, that they are generally used by planters, farmers, and contractors and manufacturers, who commit their teams to hired men. This class of teamsters and drivers are as a general thing lacking in skill and kindness, hence their methods of handling mules have given the impression that the mule is stubborn, treacherous, and can only be controlled by severe bits and heavy blows. On the other hand the testimony of owners, who treat their mules as they do young horses, and teach them kindly and by degrees how to work, and to know the meaning of the word of command, is always to the effect that there is no more faithful, reliable, and willing beast of burden than the mule.

Hon. J. B. Smith, of Pennsylvania, says he had the pleasure once of owning a pair of mules: "I bought them when they were two years old, and made up my mind that they could be broken the same as a horse, if treated in the same way. I got a friend to assist, and we went to work and broke them the same as colts, using them kindly; and a better pair of mules never were used. Any one could drive them. I could hitch them to a buggy and they would go well; all I would have to say was 'go.' I believe the mule should have the same treatment as the horse, and then he will have as kind a disposition. If you whip and scold him every time he does any thing wrong, and make a scape-goat of him generally, in course of time he will not mind any body, not even yourself. But if you treat him right, he will do right in return." Another gentleman, of large experience with mules, says, "They have a very affectionate disposition, but one peculiarity of theirs (and this same trait is peculiar to the elephant) is that of remembering and resenting an injury; therefore, the more quietly we go about handling and breaking them, the less trouble we will have with them, and the less disposition they will ever possess to kick any one. A showman once announced whilst performing his bear, that he 'broke him with kindness,' adding, 'and a club.' The mule

driver should use the kindness, and under no circumstances use a club." He says many a mule is spoiled by ignorant and thoughtless persons seizing it by the ear, and holding on to that sensitive organ, until the mule becomes so much afraid that it is almost impossible to bridle it. Some can never be entirely cured of the timidity thus produced.

The writer has had in his employ a negro who never spoke in loud or harsh tones to the mules, and could always get better work and more of it out of his team than any other driver. Other drivers would stall their teams, and beat, and curse the mules, and have to call on John to help them out with the load. Sometimes he would hitch his team to theirs and pull them out; other times he would tell the driver, "If you will go away out of sight of the mules, I will drive them out." After a few minutes of rest and a kind word of assurance, he never failed in getting the mules to pull. He never called on them to do impossibilities, yet he took pride in having his mules pull heavier loads than any other team. John's secret was kindness and self-control.

Will-power and Stubbornness.—There are some physiologists who teach that the secret of great strength is not so much in the *muscle* as in the *will*. Some men, of light muscle and slender frame, can outlift men of greater size of muscle and frame, simply because they have the will-power. A small man with a resolute purpose, amounting to stubbornness, is more difficult to overcome in a contest of strength than a larger man of weaker purpose. The term, "as stubborn as a mule," tells of the extraordinary will-power of this wonderful bundle of muscle. It is proverbial, that a mule team can outpull any team of horses of equal weight, and generally a team of mules of 1,600 pounds weight can pull as much as a team of horses weighing one-fourth to one-half more. Muscle and make of bone can not account for this. The patient, indomitable will of the mule is the secret of his power to do more work than his half brother, of greater weight and less will.

The secret of getting work out of man or boy, horse or mule, is not to antagonize his will. When mule-drivers learn

to act on this principle, we shall hear less concerning the viciousness and stubbornness of the patient, useful mule.

Economy of Mule Power.—The first cost of the mule is less than that of the horse. He is able to earn his living at two years old, and has eaten less than the colt of same age. But, as the horse is not put to work until three or four years old, the odds are largely in favor of his half-brother, whose ancestors, on the sire's side, have always lived on simple fare, and could make a meal on thistles, while the horse could not labor without his grain and fodder.

The ass family has been noted for centuries for longevity and hardiness. The mule will not eat as much as the horse; is not so liable to disease. His frugal living, and that of his ancestors, may have something to do with that, and also with the other fact that the mule is not so nervous as the horse, and not so liable to run away and damage himself and smash up things generally. The mule can not do as many kinds of work as well as the horse. It never can be as pleasant a roadster or saddle-nag. For drudgery and heavy work, the hardiness and patient power of the mule has no equal, in the hands of the average teamster.

Judge Hinckley, of Massachusetts, once a breeder of mules, and for fifty years an owner of mules and horses, gives his preference to the mules for the drudgery of farm work. One pair, thirty years old, were particularly serviceable, having outlived three generations of work-horses, and while the latter were often lame, or out of condition, and sick, these mules never were.

Another gentleman, who used mules thirty years, testifies that a large-sized mule will not consume more than three-fifths to two-thirds as much food to keep him in good order as will be necessary for a horse performing the same labor. The expense of shoeing a mule, the year round, does not exceed one-third that of the horse—his hoofs being harder and more horny, and so slow in growth, the shoes do not require so frequent removal, and from the lightness of the animal, the wear is much less. He thinks it probable that a farmer may work his team of mules

twenty years without a farrier's bill coming in. He has used mules in all work, and never had an accident from running away or fright, while horses, in that time, had caused maiming and death to themselves and human beings. The mule is more steady at a draught, and less likely to waste strength than the horse. In plowing among crops, the mule's feet being small, it seldom treads on the crop. The mule will obey implicitly, as he has plowed two tandem without lines, and done better plowing than it was possible to do with horses.

Mr. Elicott, of Patuxent Furnaces, testifies in the *American Farmer* that out of one hundred mules at the works, they have not lost on an average one in two years, and never had one that was wind-broken. They are tougher in the hoof, and shoeing is less expensive. Their skin is tougher, and they are not annoyed so much with flies and do not suffer so much with heat in summer.

We might multiply similar testimony as to the economy in using mules on the farm and at heavy work rather than horses and cattle, but enough has been said to show their exceeding great value and that the prejudice against the mule is not founded in fact.

The Longevity of the Mule.—It was a common saying during the late war, "that mules never died." One mule has been in the service of the United States over twenty-five years, and at the recommendation of General Sherman has been retired and pensioned. Pliny gives an account of one that Grecian history made eighty years old, and though no longer used for labor, followed others that were carrying materials to build the Temple of Minerva, at Athens, and seemed to wish to assist them. The people were so pleased with his conduct, that they ordered for him free egress to the public grain market.

Dr. Rees mentions two mules in England that were seventy years old. Another writer states that he saw a mule in the West Indies performing his task in a cane-mill that his owner said was forty years old. He adds that he owns a mare mule, twenty-five years old, that he has had in constant work for

twenty-one years, and he could see no diminution of her powers. Another mule is reported on the eastern shore of Maryland "to be thirty-five years old, and yet as capable of labor as at any former period."

Winter Care of Mules.—We must not lose sight of the fact that the ass is not able to endure cold, as can the horse. The history of the mule in America shows that it succeeds best in the milder latitudes. The business of rearing mules began with much spirit in the New England States soon after the Revolutionary war. They were bred for shipment to the West Indies and the South, for work on sugar and cotton plantations. Though this trade was profitable for many years, it was soon evident that the cost of wintering and feeding was so much less in Kentucky, Tennessee, and Missouri, where feed is cheaper and winters shorter, that the New England farmer must give the business over to the farmers of the West and South-west.

The breeding of mules in New England did not lead to increase of size. The cold weather, and the long winters, that kept the animals from grass and exercise for several months, had an influence to check growth, which the farmer's care did not counteract. Another element in keeping down the size was the fact that any thing of the mule kind could be sold for the Southern laborer.

The inferior class of mules at first produced a prejudice against the race, and the ready sale of inferior mules did not lead to great improvement. It was not many years, however, after mule raising in Kentucky and Illinois, where grass and grain were fed liberally and mules had range and exercise abundant, until their greatly increased size and quality brought the high prices which stimulated good breeding. These possibilities of better growth and better prices led to the use of better mares and high-priced jacks. Soon large, active mules, handsomely matched, found fancy buyers among the merchants and business men of cities, for trucks and delivery wagons. Their excellence for such uses has kept a market for them which has not yet been over-done.

Mule-raising promises to be a more profitable business than

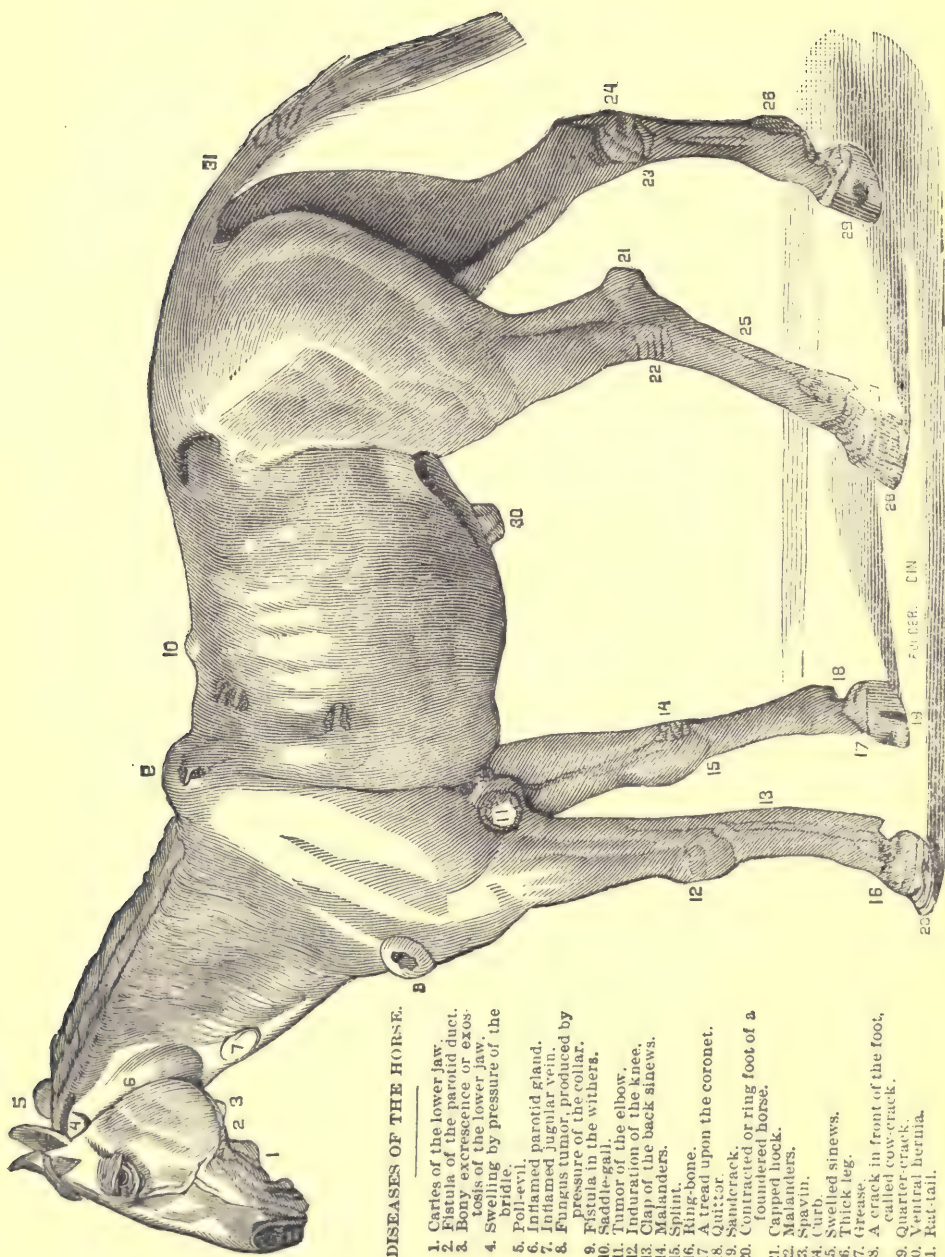
raising common horses, since a pair of good mules will readily bring more money, and will cost less to raise, and be ready for sale at an earlier age than horses. They are seldom blemished, and cost nothing to break to work.

The Hinny.—The hinny is another hybrid, the produce of a she ass bred to a horse. Like the mule it resembles its sire more than its dam. It is handsome, round-bodied like the horse, but is very small, and slow in motion. The hinny neighs like the horse, and the mule brays similarly to the ass. Though the hinny is hardier, more patient, and can endure more scanty fare, and greater privation than the horse it is inferior in all these respects to the ass and mule.

Herbert argues from the results of breeding the hinny and the mule, that they furnish strong arguments why breeders should invariably seek to have the qualities of blood, temper, courage, and spirit on the side of the sire, and those of form and size on that of the dam.

The breeder of animals will have noticed the fact that the ass is more prepotent than the horse, as the form and organization of both the mule and hinny prove. This may be accounted for on the principle of the long line of in-breeding of the ass, extending as it does many centuries back of the origin of the English thoroughbred.

The prepotency of the quagga and zebra are greater than that of the horse or even the ass, on the same principle.



DISEASES OF THE HORSE.

1. Caries of the lower jaw.
2. Fistula of the parotid duct.
3. Bony excrescence or exostosis of the lower jaw.
4. Swelling by pressure of the bridle.
5. Poll-evil.
6. Inflamed parotid gland.
7. Inflamed jugular vein.
8. Fungus tumor, produced by pressure of the collar.
9. Fistula in the withers.
10. Saddle-gall.
11. Tumor of the elbow.
12. Inflammation of the knee.
13. Clap of the back sinews.
14. Malanders.
15. Splint.
16. Ring-bone.
17. A tread upon the coronet.
18. Quittor.
19. Sandcrack.
20. Contracted or ring foot of a foundered horse.
21. Capped hock.
22. Malanders.
23. Spavin.
24. Turb.
25. Swelled sinews.
26. Thick leg.
27. Grease.
28. A crack in front of the foot, called a cow crack.
29. Quarter crack.
30. Ventral hernia.
31. Rat tail.

INDEX TO DISEASES OF HORSES.

	PAGE.		PAGE.
ABSCESSES,	723	Enteritis,	730
Ammoniacal Liniment (see cattle chapter, page 930).		Epizootic Cellulitis,	699
Anæmia (see cattle chapter, page 900).		FISTULA OF THE WITHERS,	714
Azoturia,	732	Foaling (see cattle chapter, page 908).	
BATHING (see cattle chapter, page 926).		Founder,	718
Big-leg,	707	French Stiffs,	732
Bilious Erysipelas,	707	GARGET (see cattle chapter, page 917).	
Binioidide of Mercury Blister,	736	Grease,	703
Blistering,	734	Grease-heel,	703
Bots,	737	HUMID TETTER,	704
Bruises,	723	INDIGESTION,	724
Bursal Enlargements,	716	Inflammation of the Bowels,	730
CAKED BAG (see cattle chapter, page 917).		Inflammation of the Eye,	708
Cantharides Blister,	735	Inflammation of the Conjunctiva,	708
Carbolic Lotion (see cattle chapter, page 930).		Inflammation of the Lungs,	694
Catarrh, Nasal (see also page 692)	690	Inflammation of the Pleura,	696
Choking (see cattle chapter, page 902).		Inflammation of the Lymphatics,	707
Coffin-joint Lameness,	720	Inflammatory Œdema,	707
Colic Flatulent,	727	Influenza,	697
Colic Spasmodic,	725	Inversion of the Uterus (see cattle chapter, page 913).	
Collar Galls,	712	Iodine Ointment,	737
Condition Powders (see cattle chapter, page 928.)		Itch,	705
Congestion of the Lungs,	691	KIDNEY DISEASE,	732
Conjunctivitis,	708	LAMPAS,	724
Corns,	721	Laminitis (see also page 720),	718
Cracked Heels,	701	Lungs, Congestion of,	691
Curb,	717	Lungs, Inflammation of,	694
DIARRHŒA,	729	Lung Fever,	694
Distemper,	700	Lymphangitis,	707
Dose for Young Animals (see cattle chapter, page 928).		MAMMITIS (see cattle chapter, page 917).	
ECZEMA,	704	Mange,	705
Elephantiasis,	708	Milk Fever (see cattle chapter, page 916).	
		Monday Morning Fever,	707

	PAGE.		PAGE.
Muco-enteritis,	699	SCABIES,	705
Mud Fever,	702	Saddle-galls,	713
NASAL GLEET,	692	Scratches,	701
Navicular Disease,	720	Shot of Grease,	707
Navicularthrititis,	720	Shoulderslip,	715
Nettle-rash,	705	Sidebones,	711
OPHTHALMIA,	708	Sore Eyes,	708
Ozæna,	692	Spavin, Blood,	717
PARTIAL PARALYSIS,	732	Spavin, Bog,	716
Parturition (see foaling).		Spavin, Bone,	711
Parturient Fever (see cattle chapter, page 916).		Splints,	709
Pink-eye,	699	Strangles,	700
Pleurisy,	696	Surfeit,	705
Pleuritis,	696	Sweeny,	715
Pneumonia,	694	THOROUGHPIN,	717
Poll Evil,	713	URTICARIA,	705
Puffs,	716	WATER FARCY,	707
Pulsation, etc. (see cattle chapter, page 899).		Weed,	707
Punctures,	722	White Lotion (see cattle chapter, page 929).	
RINGBONE,	710	Wind-galls,	716
Rheumatic Influenza,	699	Wolf Teeth,	724
Rheumatism (see cattle chapter, page 926).		Worms,	728
		Wounds (see cattle chapter, page 920).	

CHAPTER VII.

DISEASES OF HORSES.*

IT is the purpose of the present chapter to furnish to the owners of horses and cattle a plain, practical, thorough, and reliable treatise on the causes, symptoms, and treatment of the diseases to which those animals are subject. It is intended to make each case so clear that any person of ordinary intelligence may be able to detect and treat each disease with certainty and success. It is *not* intended to convert all stock-raisers into veterinary surgeons. The necessity will still remain as before for the practiced and qualified surgeon; but it does not follow, any more than in the case of the diseases to which human beings are subject, that the skillful physician is to take the place of a general knowledge of the causes, nature, and cure of the ills to which all flesh is heir. It is hoped that without any arrogance of assumption, and in consideration of a long and carefully conducted education, it may be modestly and yet confidently asserted that the current chapter presents *the very best* that is known with reference to the diseases of horses and cattle, and of the agencies to be employed in the prevention and cure of all such ailments. It is only necessary to add in this opening paragraph a single general remark, and that is

*The veterinary department of this volume has been very carefully compiled and edited by R. W. STEWART, D. V. S., from stenographic notes of lectures delivered at the veterinary colleges of Toronto and New York city, by the most eminent veterinary surgeons of the United States and Canada. To his extensive and profound theoretical education the author has also added many years of careful observation and practical experience in the professional treatment of animals. What he has produced in the present work, therefore, may be relied upon as the most valuable and authentic treatise on the subject ever offered to the farmers and stock-raisers of our country.—THE PUBLISHERS.

with reference to the treatment of those diseases which are *common to both cattle and horses*. The principle, as it relates to the administration of medicine to these two species of animals, is simply this: *The cow requires the larger dose by about one-third of the amount given to the horse*. In the prescriptions, therefore, if the dose named is prescribed for a horse, and reference is made to it from the cattle chapter, about one-third of the dose given for the horse should be added to get the proper dose for a cow. On the contrary if the treatment for a cow is taken, from which reference is made for the treatment of a horse, only about three-fourths of the prescribed quantity should be given. An observance of this general rule is all that is required in order to enable the farmer or stock-raiser to prescribe intelligently to either class of animals from the table of recipes prepared for the other class.

Nasal Catarrh.—Nasal Catarrh means a running or discharge from the lining—mucous membrane—of the nose, and sinuses of the head. It is an inflammation of this membrane.

CAUSES.—Exposure to the cold; sudden changes of temperature; standing in a draft of cold air; ill ventilated stables, and being exerted when in a weakened or debilitated condition.

SYMPTOMS.—At first there is slight dullness; the appetite may be poor; then the hair becomes rough; the throat more or less sore, but the pulse and breathing are but little affected as a rule, and there is a discharge from the nose. The discharge at first will be thin and watery; then it becomes whitish and then yellowish; varying according to the severity of the attack. This discharge may be very great, but it is not an unfavorable sign. A small amount of urine is usually passed.

TREATMENT.—Place the animal in a comfortable, well ventilated place, and if the weather is cold, use blankets to make him comfortable, and if the bowels are costive, a small dose of physic may be given (but physics should be used sparingly in catarrh).

Take—Barbadoes Aloes,	. . . . .	4 drams.
Water, boiling,	. . . . .	1 pint.

Mix, and when cool give, as a drench, at one dose. After three or four hours,

Take—Sweet Spirits of Niter,	2 ounces.
Laudanum,	1 ounce.
Water,	$\frac{1}{2}$ pint.

Mix and give at one dose. If this is done in the beginning, it may arrest the attack. Give nitrate of potash, four drams, three times a day, in the food, drink, or in a drench of cold water; and bathe the nostrils with warm water, or cause steam to be breathed, but not too hot. If there is a cough, bathe the throat with the ammonical liniment (see index), or

Take—Mustard, powdered,	3 ounces.
Water, hot,	1 quart.

Mix and bathe the throat with it. Give loosening food. If the discharge from the nose continues too long, give sulphate of iron, two drams, twice a day; or chlorate of potash, two drams three times a day; or sulphate of copper, one dram, three times a day, and after giving any one of these for a week, it is best to change to some other.

Congestion of the Lungs.—This consists of an increased amount of blood in the lungs, which interferes with the breathing. It is the most common disease of the lungs, and goes before inflammation of the lungs.

CAUSES.—Driving an animal fast, when in a weakened condition, is the most common cause. It follows influenza and catarrh, and is sometimes caused by breathing impure air, and possibly by a draft of cold air. A bloated condition of the bowels which greatly interferes with the breathing may cause it.

SYMPTOMS.—If it is caused by over exertion, the animal will be sluggish, will tremble—especially in the flanks—and will breathe with difficulty. The nostrils will be wide spread; the pulse quick and labored, and sometimes indistinct; the membrane lining the nose and eyes will be red, and a peculiar gurgling noise can be heard by placing your ear to the side of the chest. His ears and legs will be cold; he persists in standing, but may, in some cases, lie down, but soon jumps up again. It is sometimes produced very suddenly.

TREATMENT.—In this and in all similar diseases, first see that plenty of fresh, pure air can be obtained without a draft of wind—the animal would be better in the open air than in a close, poorly ventilated stable—keep him well blanketed, and

Take—Carbonate of Ammonia,	. . . . .	2 drams.
Water,	. . . . .	8 ounces.

Mix, and when dissolved, add either of the following :

Take—Sulphuric Ether,	. . . . .	1 ounce.
Laudanum,	. . . . .	$\frac{1}{4}$ ounce.
Or—Sweet Spirits of Niter,	. . . . .	1 ounce.
Laudanum,	. . . . .	$\frac{1}{4}$ ounce.

Mix and give as one dose, and repeat every two hours until relieved. Rub the body well, bandage the legs, and keep him warm; or bathe the legs with warm water and then bandage. Give injections of warm soap-suds, and when he seems relieved do not give more medicine as above, but give nitrate of potash, three drachms three times a day. But if no relief is soon afforded by the medicines prescribed, apply to the sides blankets wrung from hot water and covered with dry ones. If other symptoms are relieved, and the pulse still runs high, give tincture of aconite-root, ten drops well diluted in water, and, if necessary, it may be repeated once or twice at intervals of two hours, but aconite should be used very cautiously in this disease. When an animal is recovering, he should be used very carefully for a long time. Very moderate, but regular, exercise is needed, and he should not be exposed to the cold. Tonics are necessary. Give gentian powders, one-half ounce three times a day, or give the condition powders as recommended for colic. (See Index.) If he is worked before he is in a healthy condition, he will be very liable to have it again.

Chronic Catarrh.—Also called *Nasal Gleet*, *Ozæna*, etc. It is a chronic inflammation of lining membrane of the nose and sinuses of the head.

CAUSES.—Neglected catarrh; exposure and lack of food; an injury to the bones of the face, sufficient either to fracture the bones or to injure the blood vessels inside, or a rotten tooth. Chronic catarrh is a symptom of bad teeth. It may be caused

by a tumor, or by some foreign substance getting into the nose from the throat. This last cause is frequent from an animal choking and coughing, which throws the food into the nose.

SYMPTOMS.—There will be a discharge from the nose either whitish or yellowish in color, which may be retained in the nose for some time, and then expelled in large quantities. The lining membrane of the nose may either be reddened or of a lead color; but there are no ulcerated patches, as in glanders. There may be swelling of the glands of the throat, especially if it is caused by a diseased tooth. Sometimes catarrh can be detected by tapping upon the face with the fingers. If the linings are diseased and swollen, tapping does not give the hollow sound as heard in a healthy animal. An animal having catarrh becomes thin in flesh, and “hide-bound,” as it is called. After the disease has run on for a long time, the discharge is exceedingly offensive, especially if caused by a diseased tooth. The discharge of glanders is not so offensive, and its color is more of a greenish tint. In making an examination, always examine the teeth.

TREATMENT.—As a rule, no physic is needed. Feed the animal well; allow plenty of fresh air and some exercise; wash the nostrils thoroughly clean two or three times a day and give

Sulphate of Iron,	2 drams.
Or Iodide of Potash,	3 drams.
Or Sulphate of Copper,	1½ drams.

Give either of the above twice a day. Or balsam of copaiba may be given instead, in three dram doses three times a day. The best preparation of iron is the iodide of iron, given in two drachm doses twice a day, but it is more expensive than the sulphate of iron. In many cases a blister over the parts does great good.

In some cases it is also necessary to make an opening through the bones of the face in order to let the matter escape. This operation is called trephining, and should be performed with an instrument called a trephine; but it has been performed with an ordinary brace and a three-fourth inch bit. When this has been done the hole should be kept open and syringed once a day

with the carbolic lotion. (See Index.) If there are any rotten teeth, remove them.

Another convenient mode of treating this disease is,

Take—Sulphate of Copper,	2 drams.
Cantharides, powdered,	5 grains.
Or—Sulphate of Iron,	1 dram.
Arsenic,	3 grains.
Strychnine,	2 grains.

Mix either of these into one pill with flour, molasses, etc., and give one such pill in the morning and another at night; or,

Take—Iodoform,	2 drams.
Nitrate of Bismuth,	1 ounce.

Powder, and mix thoroughly, and blow the powder in the nose twice a day with a powder-blower, or

Take—Iodoform,	1 dram.
Sulphuric Ether,	1 ounce.

Mix, and use in the nose with a spray syringe.

Pneumonia.—Also, *Inflammation of the Lungs, Lung Fever, etc.* This disease may occur either in an acute or a chronic form, may effect a part or the whole of one or both lungs. It is often connected with pleurisy and other diseases. When it occurs in connection with pleurisy, it is called pleuro-pneumonia.

CAUSES.—Improperly ventilated stables; sudden changes of temperature; exposure to cold; over-driving, etc. It may also occur from a case of neglected catarrh. Breathing impure air or smoke, or taking strong medicines without being well diluted, may cause first bronchitis and then pneumonia. Young animals are most liable to it.

SYMPTOMS.—It usually begins with a chill, after which the body becomes hot; the ears and legs become hot and then cold; the mouth hot and sticky, and the breathing slightly affected at first; the pulse will be quick and may be full; the animal hangs the head and continues standing; the eyes have a glassy look, and the lining of the nose and eyes is redder than natural; and there will be a peculiar flapping of the nostrils, and a heavy, sighing breathing. A symptom, which often misleads, is costiveness of the bowels, and the dung dropped will be covered

with slime. By placing your head to the side of the chest, a sound something like that heard by rubbing your hair near your ear between the thumb and finger can be heard. If the animal is turned loose in a stable with an opening near, he usually will stand with the head to the hole, which shows a desire for pure air. He should be permitted to have plenty of pure air, yet no draft should be allowed to blow upon him.

In the last stage of the disease, the pulse may run as high as one hundred beats per minute. The difficulty in breathing and flapping of the nostrils also increases; and there will be a discharge of a reddish-brown color from the nose; the breath will stink, and nothing will be eaten. The animal stands; he notices nothing, his mouth is cold, and the pulse becomes indistinct. In such a case death will soon give relief.

TREATMENT.—Clothe the animal, sufficiently to make him comfortable, and if he is a strong, otherwise healthy animal, and there is very high fever and a quick pulse, give ten drops of the tincture of aconite-root, largely diluted in water, repeated in two hours, if necessary, until the fever is reduced or the pulse made slower or weaker. But if the animal is in poor condition and the above symptoms are present, give four drams of nitrate of potash three times a day instead of aconite; and relieve any violent symptoms in either case by giving half ounce doses of laudanum, repeated every one or two hours as thought necessary. Always encourage the animal to eat. A bran mash is good, but if that will not be eaten, then give any thing that will be eaten; but in no case should food be forced upon him. After the aconite or opium has given some relief,

Take—Sweet Spirits of Niter,	2 ounces.
Cold Water,	1 pint.

Or whisky may be given in four ounce doses instead of the spirits of niter; repeat every three or four hours; place hot-water cloths on the sides and cover these with dry ones. Or,

Take—Mustard,	2½ ounces.
Water, hot,	1 quart.

Rub this over the sides very quickly, and promptly cover the parts with papers, oil cloth, or blankets, to prevent the air from

getting to it. When the animal begins to get better, give loosening food or flaxseed-meal to bring the bowels into action. If the cough is troublesome,

Take—Tincture of Digitalis,	. . . . .	$\frac{1}{2}$ dram.
Laudanum,	. . . . .	2 drams.
Water,	. . . . .	2 ounces.

Mix; give as one dose three times a day.

Pleurisy.—Also called, *Pleuritis, Inflammation of the Pleura, etc.* The membrane which lines the chest cavity, and also covers the diaphragm and lungs, is called the pleura. And an inflammation of this is called pleurisy, etc.

CAUSES.—Sudden changes of the weather; exposure to the cold; driving an animal until heated, and then standing him in the wind, or in a cold damp stall without blanketing him. Any injury over the ribs sufficient to injure the lining will cause it.

SYMPTOMS.—It usually begins with a chill, followed by fever and a rapid pulse; pressing between the ribs or tapping against them causes pain; turning the animal quickly causes pain, often causing the animal to grunt or groan. There can also be seen a hollow line running along the lower ends of the ribs and extending back to the flank. If the ear is placed over the seat of the disease in the early stage, a sound like rasping to and fro can be heard. The ears and legs are cold, or alternately hot and cold. If but one side is affected, the affected side will be held as nearly still as possible, which tends to cause the other side to do more than its natural amount of work; this fact causes an increased motion on the sound side, and a decreased action on the affected side; this is more noticeable in cases where water has collected in the chest on one side only. When water has collected to any great extent in the chest, the breathing becomes quick, shallow, and painful, the muscles of the belly doing a large amount of the work. There is also present a painful hacking cough, and a grunt is given every time air is expelled from the lungs. The animal may lie down, which he seldom does in lung fever.

TREATMENT.—Give the very greatest attention possible to the comfort of the animal; keep the stable well cleaned and well venti-

lated, yet allow no draft of air to enter. If the weather is cold, keep the patient warm with blankets. If the weather is warm, apply over the chest a blanket wrung from hot water, cover with a dry blanket or oil cloth, and, as soon as it cools, apply another. But if the weather will not admit of this, a blanket may be placed over the chest, a piece of heated sheet-iron placed next this and covered with another blanket. If the fever runs high, give the tincture of aconite-root, 20 drops every two hours until relieved. (In giving this remedy alone, always dilute it largely with water.) If the kidneys are not active, give powdered colchicum, 30 grains three times a day until they do act. If the foregoing are not needed, or if needed and have acted,

Take—Liquor Acetate of Ammonia,	3 ounces.
Gentian, powdered,	4 drams.
Epsom Salts,	3 ounces.
Water,	1 pint.

Mix, and give at one dose; or you may use sweet spirits of niter instead of the ammonia as above. Repeat this dose (omitting the salts) every three hours as long as needed. If there is great pain, also give powdered opium, one dram every two hours until the pain is partly relieved, as it would require too much opium to relieve it entirely.

Influenza.—This disease is caused by some poison in the blood, by some atmospheric influence which can not be precisely ascertained. There is some difference of opinion as to whether it is either infectious, or contagious, or not; hence it is safest to keep affected animals away from healthy ones. It occurs more or less every year, and in some years it occurs as an epizootic. It may attack any of the internal organs, but the respiratory system is the one most frequently attacked. It occurs most frequently in poorly kept horses in crowded stables, but it may and does attack all kinds of horses, in all conditions and surroundings.

CAUSES.—As stated at the beginning, the causes are not very definite. But there are some things that help to cause it; as poorly-ventilated, crowded, or underground stables, a deficient supply of food, either in quantity or quality, and irregular exercise.

SYMPTOMS.—The early symptoms are, a dull, languid appearance and a poor appetite, a sweating freely from slight exertion, the hair stands on end and presents a dirty appearance, the mouth is hot and dry, and there may be a cough. Later the symptoms become more plain, the bowels are usually costive and the dung is passed in small, dry lumps; the pulse weak and quick, varying from sixty to eighty beats per minute, and there seems to be intense headache. When caused to move, the patient seems so weak that a little push might throw him over. Sometimes the breathing is greatly interrupted, which, in most cases, is best seen at the nostrils. The throat sore and the bronchial tubes become partly closed, and a peculiar noise can be heard by placing the ear to the chest. To describe these sounds is very difficult, practically impossible; hence, to distinguish healthy from unhealthy sounds, first listen to a healthy and then to a diseased animal. The legs and ears may be hot, and in an hour, normal, or even cold, while the general temperature may be regularly increased. (The eyes sometimes become reddened and swollen, and from this condition of the eyes, this variety of influenza takes the name of pink-eye.) A yellowish-white discharge from the nose is a favorable sign, but if it is of a reddish, brown, or rusty color, it is a bad symptom. In cases in which the breathing is troubled, blood may be discharged from the nose, which is also an unfavorable sign. It may terminate in inflammation of the bowels. If the liver is greatly affected, the eyes and the lining of the nose will be yellowish in color, and the bowels will at one time be costive, and at another time there will be diarrhea. Sometimes the legs, sheath or udder, and belly swell, and if the swelling takes place in the first stage of the disease, and is slight, and confined to the legs, it is a favorable sign. If it takes place in the latter stages, and extends to the belly, sheath or udder, etc., it is an unfavorable sign. When the lungs are the seat of the disease, the symptoms are similar to those in the advanced stage of lung fever.

TREATMENT.—Plenty of pure air, without any draft of air on the animal, is of the greatest importance. If necessary to keep

him warm, use two or more blankets, bandage and hand-rub the legs, and use such means as will make the animal most comfortable. It is a disease which will run its course in spite of medicines, hence it becomes necessary to support the system until nature throws off the disease. If the fever is severe, give nitrate of potash, three drams, three times a day. If there is but little fever, give chlorate of potash, one dram, three times a day, instead of the nitrate. Feed well on good, nourishing food, being careful not to over-feed him. If the animal appears weak,

Take—Liquor Acetate of Ammonia,	. . . . .	2 ounces.
Sweet Spirits of Niter,	. . . . .	1 ounce.
Water,	. . . . .	6 ounces.

Mix; give as one dose three times a day. Or ale, beer, whisky, or milk may be given. Endeavor to get the bowels to act by giving injections, and in rare cases, when injections do no good, a half-pint of raw flaxseed-oil may be given, which is preferable to aloes, but aloes may be given, in doses of two to four drams, but not repeated. If there is great difficulty in breathing, give tincture of digitalis, one dram, repeated night and morning. When there are signs of recovery, and the eye has its natural, clear appearance, and the appetite becomes good, give sulphate of iron, one dram, three times a day; or, if the legs are much swollen, give iodide of potassium, two drams, three times a day; or, if the nerves are much affected, give bromide of potassium, two drams, three times a day, or nuxvomica, powdered, thirty grains, twice a day.

Pink-eye.—This disease is a variety of influenza, and is called *Rheumatic Influenza*, *Muco-Enteritis*, *Epizootic Cellulitis*, etc. The distinguishing symptoms of this disease are the swelling of the eyes and legs, and soreness of the joints. The dung passed is often dry and hard, and is covered with a kind of mucus. For a more extensive description, see influenza.

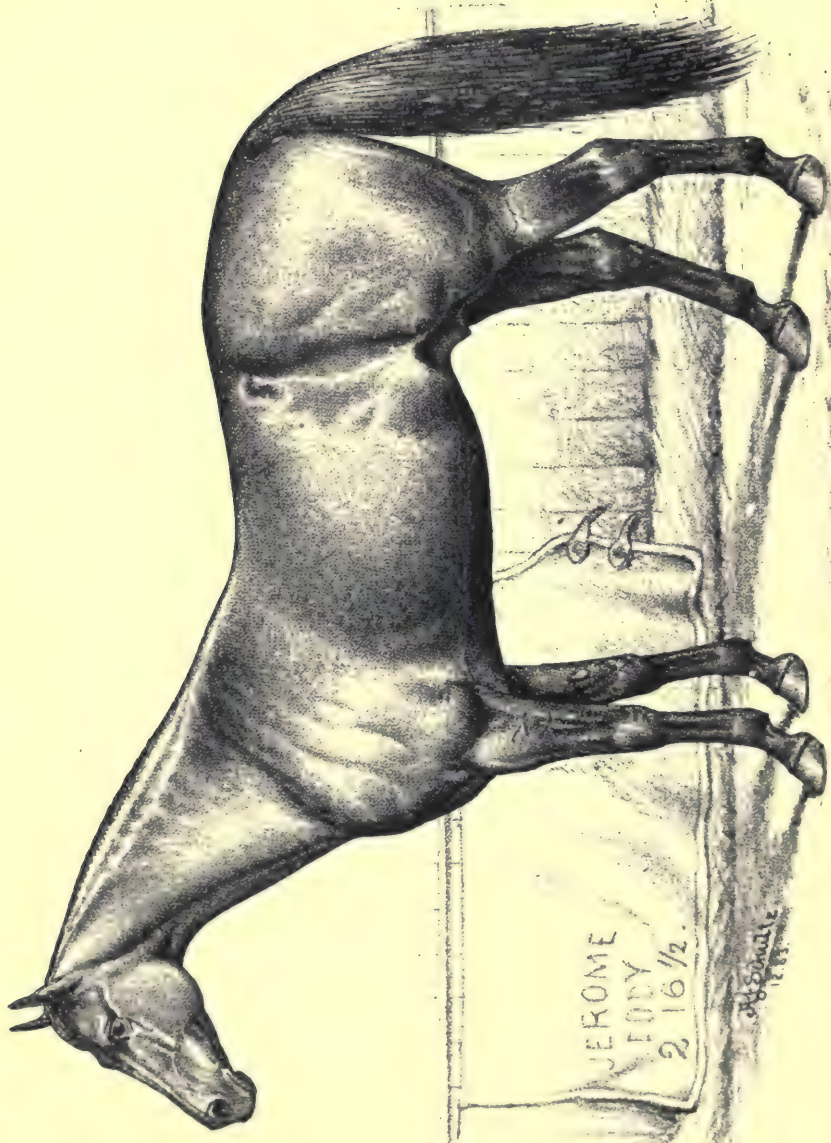
TREATMENT.—In general the treatment of influenza and pink-eye are just the same; but in pink-eye, some recommend giving muriate of ammonia, two drams, three times a day, given in a pint of water, or give liquor ammonia acetis, two ounces, three

times a day in a half pint of water. A physic would not be advisable. If there is fever give nitrate of potash, three drams, three times a day, in the drinking water. Give good food, and when recovery commences, give quinine, fifty grains, three times a day, or nux vomica, thirty grains, twice a day, made into a paste with flour and molasses, and placed back on the root of the tongue, or give in any other way which is more convenient.

Strangles—Distemper.—This disease usually attacks young horses. Some say it is a contagious disease; others say it is not. Some say it attacks the same animal but once; yet some cases show that it may be taken a second time.

SYMPTOMS.—At first the animal is dull and stupid, and is easily fatigued; the disease progresses slowly until a swelling appears under the jaw; then the head will be held in a very peculiar position; the slobbers will fall from the mouth; the pulse will be slightly affected; the bowels will be costive; and the hair will stand on end. It is difficult to say whether it is strangles or an inflammation of the throat until the swelling appears. The swelling may be such that it will greatly interfere with the breathing. There will generally be a discharge from the nose. The disease usually runs its course in from six to twelve days; and the horse is often well in twenty days. In some cases, all these symptoms are presented, except the tumor at the throat, and, instead of forming on the throat, it will form on the shoulder, in the groin, or elsewhere. If the tumor comes on the point of the shoulder, near the wind-pipe, it should be watched carefully, opened on the outside, and not allowed to burst inside. If these tumors form internally, as they sometimes do, they usually kill the animal.

TREATMENT.—Allow the disease to run its course, as checking it often proves fatal. Blanket well, if the weather is cold; and if the breathing is interfered with, put him where pure air can be freely breathed (this is always necessary); feed soft, easily digested food—boiled food is best; but if this will not be taken, feed any thing that will be taken. In the first stages, chlorate of potash, in dram doses, may be given three times a day, or nitrate of potash, three drams three times a day. If the



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breathing is much troubled, it may be necessary to apply the ammoniacal liniment. (See Index.) If in the summer, a poultice will be needed. If it is a mild case, the abscess should be allowed to form thoroughly before opening it. After the tumor has been cut open, give sulphate of iron, one dram, three times a day for a few days, and bathe the wound with tepid water. In some more tardy cases the abscess does not form or point soon enough, and at the same time it greatly interferes with the breathing; poultice, if in warm weather, but if in cold weather, apply heated wool to the part to keep it warm; also causing the animal to breathe steam, not too hot or too much of it, is beneficial. In such a case it may be necessary to open the abscess much sooner than in a milder case. And it is also sometimes necessary to perform tracheotomy, which is cutting into the wind-pipe, about half way down the neck, and inserting a tube through which the animal may breathe until the tumor decreases in size, so that the animal may again breathe naturally. This operation will not here be described, as a surgeon should be called at once. The pus of strangles may be absorbed into the circulation, and cause blood-poisoning, and abscess in any part of the body. This may occur from a wound also. In some cases in which the bowels are costive, it may be necessary to give a slight dose of physic, as four or five drams of aloes first dissolved in hot water and given when cool, yet this is seldom necessary. Always give injections of warm soap-suds, which in most cases is all that is necessary to cause the bowels to act.

Scratches—Cracked Heels.—This is at first confined to the outside layer of the skin, but if not checked it will implicate the deeper structures.

CAUSES.—Permitting the legs to remain wet or muddy. When the legs are wet and muddy they should be dried and bandaged.

SYMPTOMS.—More or less swelling about the heels. The animal travels stiffly when first taken from the stable, but soon gets better. In some cases the foot will be lifted, like string-halt. Blood may ooze through the skin. If this disease is not checked it will often terminate in grease.

TREATMENT.—Give bran-mashes for a day or two, and then dissolve six drams of Barbadoes aloes in boiling water and give when cool. Wash the dirt from the legs with warm water, and, if there is much heat and tenderness, apply a slight poultice of flaxseed-meal, after which use the white lotion. (See Index.)

Or take—Carbolic Acid, pure, 1 dram.
 Alcohol, 1 “
 Water, 1 pint.

Mix, and bathe the heels with it two or three times a day. If the heels become hardened, bathe them with

Iodide of Potassium, 2 drams.
 Iodine Crystals, 4 “
 Water, 12 ounces.

Use as the foregoing; or if unhealthy granulations, proud flesh, spring up, rub a stick of nitrate of silver over them once every one or two days, and give

Salt peter, 2 drams.
 Rosin, 2 “

Mix, and give at one dose, once a day for three or four days. But never use hot liniments, or you may cause it to terminate in mud fever.

Mud Fever.—Mud fever is an inflammation of the skin. It is caused by wet and mud on the legs, and is aggravated by washing and not drying the legs.

SYMPTOMS.—The legs will be swollen, stiff, and extremely hot and tender; the hair comes off pretty easily; and, if it is allowed to run too long, it may prove a serious trouble.

TREATMENT.—It is best, in most cases, to give a small dose of from four to six drams of aloes dissolved in hot water, and given when cool. Give bran-mashes and other cooling food. If the legs are greatly swollen, bathe in warm water, cleanse them nicely, and then dry them well; but do not rub them hard. When it begins to get better, and the swelling partly disappears, some moderate exercise is useful; but do not allow the legs to get wet or dirty. Sometimes abscesses form from this, as

high up as the groin. They should be opened and the matter let out.

Take—Sulphate of Zinc,	6 drams.
Sugar of Lead,	8 drams.
Water,	1 quart.

Mix, and bathe the legs with it once a day. Or,

Take—Carbolic Acid,	6 drams.
Water,	1 pint.

Mix, and use as above.

Grease — Grease-heel. — This results from neglected scratches. It is not contagious; nor are parasites present, unless they occur merely by accident. If grease is allowed to run on, without being checked in its progress, it takes on a kind of fungoid growth. It then presents an appearance something like a bunch of grapes. This is called the grapy stage, in which there is a very offensive smell.

CAUSES.—Sudden changes in temperature; washing and not drying the legs; standing in filthy stalls; high feeding without exercise; allowing a blister to affect the hollow of the heel, just under the fetlock; getting the foot over a halter-strap, etc.

SYMPTOMS.—At first a slight swelling, and (if in a white horse) redness around the heels; the hair stands out; the heels are hot and tender; fissures or cracks appear in the heels, in some cases extending up to the fetlock. There is a discharge of matter, also, and the horse walks stiffly, almost lame.

TREATMENT.—If it has attained the grapy stage, it is difficult to cure it. If the animal is healthy and fat, give bran-mashes for a day or two, and then dissolve seven drams of aloes in hot water, and give when cool. If the hair stands out much, clip it off, and apply a poultice of flaxseed meal, with a little carbolic acid added, to destroy the bad smell. Then bathe two or three times a day with

Sugar of Lead,	40 grains.
Water,	1 ounce.
Or— Chloride of Zinc,	40 grains.
Water,	1 ounce.

Or, apply the following twice a day:

Take—Sulphur,	1 ounce.
Bicarbonate of Soda,	4 ounces.
Carbolic Acid (pure),	2 drams.
Olive Oil,	16 ounces.
Lard,	16 ounces.

But, if it has attained the grapy stage, it is sometimes necessary to dust the parts with powdered blue vitriol; or, rub them with a stick of nitrate of silver, or even sear them with a red-hot iron, and then treat as above.

Simple Eczema—Humid Tetter.—This is a skin disease; is not contagious, and is not caused by parasites. Mange is contagious, and is caused by parasites; yet eczema is often mistaken for mange. It is more liable to attack horses that are well fed; mange attacks horses in poor condition more readily.

SYMPTOMS.—At first there is a slight dryness about the head, neck, ears, and tail; then little pimples appear. The animal scratches until the places become sore. The only way to be positively certain whether it is eczema or mange is to examine some of the scabs with a microscope, and if parasites are found it is surely mange; if parasites are absent it is not mange.

TREATMENT.—It is difficult to effect an entire cure; for, although seemingly cured, it will frequently return during the following summer. To relieve the itching and irritation,

Take—Corrosive Sublimate,	2 drams.
Alcohol,	4 drams.
Water,	1 pint.
Or—Carbolic Acid (pure)	1 ounce.
Water,	1 pint.
Or—Iodine Crystals,	1 ounce.
Iodide of Potash,	$\frac{1}{2}$ ounce.
Water,	8 ounces.

None of these should be used on too great an area of the body at one time; but use on one part one day, and another part the next day, and so on. Also give, internally,

Iodide of Potash,	3 drams.
Or—Nitrate of Potash,	4 drams.
Or—Hyposulphite of Soda,	3 drams,

Three times a day, for two or three days. Professor Williams gives the following as his favorite internal medicine :

Take—Arsenic,	1 dram.
Bicarbonate of Soda,	1 dram.
Water,	12 ounces.

Mix, and heat slowly, until the arsenic is dissolved ; then strain through a cloth, and give a half ounce at a dose twice a day. If the swelling remains in the legs after the soreness has subsided, a bandage applied, to give slight pressure, is very useful.

Surfeit.—Also called *Nettle-rash and Urticaria*.

CAUSES.—Any thing that will irritate the skin: stings of insects, sudden changes of temperature or diet, disorders accompanying pregnancy, disorders of the digestive system, or any defective action of the kidneys.

SYMPTOMS.—There are small elevations or lumps called wheals. These wheals vary in size, from that of a pea to that of a chestnut, or larger, in rare cases, and appear suddenly on any part of the body, and are liable to disappear as suddenly as they came, and again reappear on the same or some other part of the body. They are elastic, and give way to pressure. They are filled with a fluid which is sometimes discharged by the bursting of the enlargement.

TREATMENT.—Give six drams of Barbadoes aloes, and, in six or eight hours,

Take—Nitrate of Potash,	2 drams.
Camphor Gum,	1 dram.
Oil of Juniper,	1 dram.

Mix. Give at one dose, three times a day, until the lumps disappear, Or,

Take—Iodide of Potash,	2 drams.
Colchicum (powdered),	20 grains.

Mix. Give as one dose, three times a day, as above.

Mange—Scabies—Itch.—This is a skin disease caused by parasites. It occurs in the horse, ox, sheep, dog, and man, and can be transmitted from one to another. Animals in poor condition, with long, dirty hair are most liable to have it, but

none are exempt. It can be carried on the harness, saddles, bridles, brushes, combs, etc.

SYMPTOMS.—The parasites cause an irritation, which terminates in pimples; sometimes the hair falls off or is easily pulled out. The itching is extremely severe, but to be certain about the disease, the only method is to use a microscope, and if there are parasites present, it is mange; if not, it is not mange. The itching generally begins about the mane or tail. The symptoms of eczema are much the same, but eczema is more severe, and spreads more rapidly than mange. Sometimes the parasites of mange can be seen without the aid of a microscope, by placing some of the scales on a piece of white paper in bright sunlight.

TREATMENT.—If it is in the summer, clip the hair off, and then

Take—Carbolic Acid,	. . . . .	1 ounce.
Water,	. . . . .	1 pint.

Mix and apply with a brush; or mercurial ointment, which is kept by druggists is a good remedy; or

Take—Tar,	. . . . .	4 ounces.
Sulphur,	. . . . .	4 “
Flaxseed Oil,	. . . . .	4 “

Mix and apply; but this makes the animal very dirty. The iodide of sulphur is also very good, and is also very dirty. Another:

Take—Creosote,	. . . . .	1 dram.
Sweet Oil,	. . . . .	4 ounces.

Mix and apply once a day; or,

Take—Wood Tar,	. . . . .	$\frac{1}{2}$ pound.
Soft Soap,	. . . . .	1 pound.

Water enough to dissolve these sufficiently to apply with a sponge or brush.

It is often necessary to change from one remedy to another, every few days. And none of these remedies should be applied to a very large surface of skin at one time; but apply to one part one day, wash this off the next, and apply the remedy to

another part, and so on. Also before applying any of these medicines, the parts should be thoroughly washed with soap and water, to which some common soda may be added. The animal should be well fed, and if it is in poor condition,

Take—Arsenic,	2 grains.
Sulphate of Iron,	2 drams.

Powder and mix, and give as one dose, twice a day. Thoroughly cleanse the harness, saddles, brushes, stalls, etc., and sponge them with the carbolic acid and water, as just given.

Lymphangitis.—This disease is known by a number of names, as: *Inflammation of the Lymphatics, Weed, Water-farcy, Monday morning Fever, Inflammatory Odema, Big-leg, Bilious Erysipelas, Shot of Grease, etc.* It usually attacks only one hind-leg, but may attack both; and sometimes it attacks one or both fore-legs. It is an inflammation, first of the lymphatic glands, and then extends to the lymphatic vessels. Heavy horses are most liable to it.

CAUSES.—Keeping a working horse in the stable for a day or two, and giving the same amount of food as when the horse was working. It is thus often seen in stables on Monday mornings, hence one of its names. Any injury to the part, a nail or prick in the foot, and a debilitated condition of the blood, all tend to cause it.

SYMPTOMS.—It often comes with a chill, but this is seldom noticed; then there will be high fever, the horse becomes very lame, and the affected leg or legs greatly swollen. The swelling usually begins on the inside of the leg near the body, and extends down the leg in a kind of hard cord. Pressure on the swollen part causes great pain. The swelling may extend entirely around the leg. If so, it will be very difficult for the horse to bring the leg forward in walking. The pulse will be about fifty or sixty beats per minute, and full and bounding. The breathing will be quickened, the bowels costive, the urine high colored, and the animal often sweats some. The appetite is often impaired, but the thirst will be very great. As a rule the animal will continue standing, but he may lie down; and if once down, he has trouble in getting up. He will often look at

the sides as in colic. This disease tends to leave the leg enlarged. It is then called elephantiasis.

TREATMENT.—If the horse is in good condition and in good flesh, dissolve eight drams of aloes in hot water and give when cool. Or, Finley Dun gives as a physic :

“Take—Calomel,	. . . . .	1 dram.
Aloes,	. . . . .	5 drams.”

Mix. Shake up in warm water and give when cool. And give tincture of aconite-root, ten drops, in a tablespoonful of water every two hours until the fever is relieved; then give nitrate of potash, three drams, three times a day. Injections of warm soap suds should be given until the physic begins to operate. Bathe swollen parts with warm water; keep up the bathing for three or four hours. A hay rope made of soft hay and wrapped around the leg, from the foot up, is a very good way to apply and retain heat and moisture, but care must be exercised in applying it, or it will get too tight and do harm. After bathing with water, tincture of camphor may be applied; or, when there is great pain,

Take—Fluid extract of Belladonna,	. . . . .	1 dram.
Water,	. . . . .	1 ounce.

Mix, and bathe the leg after using warm water, or

Take—Tincture of Opium,	. . . . .	2 drams.
Water,	. . . . .	1 ounce.

Mix, and use as the belladonna.

Elephantiasis.—This is a chronic enlargement of the leg, caused by repeated attacks of lymphangitis or grease, especially if strong or hot liniments are used. When this disease is of long standing it is incurable, but gentle exercise, hand-rubbing well, restricting the diet, and applying a rubber bandage loosely for a long time, may reduce it some.

Conjunctivitis—Sore Eyes.—Also called *Simple Ophthalmia*, *Traumatic Ophthalmia*, *Inflammation of the Conjunctiva*, etc. It is an inflammation of the lining membrane of the eyelids and the covering of the eye-ball.

CAUSES.—Any injury. Striking the eye with a whip; getting sand and dirt into the eyes; keeping an animal in extremely

dark, or extremely foul stables; very hot weather or very bright sunlight may cause it. But it generally comes from some injury.

SYMPTOMS.—The eye is partly or entirely closed. Tears run down the face. There is generally supposed to be a film over the eye, but this is a mistake, it is only an exudation between the layers of the cornea. The eye also seems to be sunken in its socket.

TREATMENT.—If caused by dirt, hay-seed, etc., remove it with a feather, or camel's-hair brush; and apply warm water to the eye for a long time each day, for a day or two; keep the animal in a dark place, and if there is great pain, use one of the following:

Take—Laudanum,	. . . . .	10 drops.
Sulphate of Zinc,	. . . . .	2 grains.
Water,	. . . . .	1 ounce.

Mix, and apply with a camel's-hair brush or a small syringe; or,

Take—Atropine Sulphate,	. . . . .	2 grains.
Distilled Water,	. . . . .	1 ounce.
Or—Sulphate of Copper,	. . . . .	5 grains.
Water,	. . . . .	1 ounce.

Apply as above. If the white or cloudy appearance remains, use

Nitrate of Silver,	. . . . .	5 grains.
Distilled Water,	. . . . .	1 ounce.
Or—Iodide of Potash,	. . . . .	5 grains.
Water,	. . . . .	1 ounce.

Use any of the above washes, two or three times a day, applying with a camel's-hair brush or fine feather.

Splints are bony enlargements, usually on the inside of the fore-leg below the knee, but they sometimes occur on the outside of the leg. They are rarely seen on the hind-leg. They are usually seen on young horses, but they may be seen on old ones.

CAUSES.—Irregular or hard work; shoeing with heavy shoes, which bring the feet to the ground with great force. Horses that are driven on hard roads are more subject to splints than race horses, although the latter are more violently driven, but on soft roads.

SYMPTOMS.—If the growth has attained sufficient size, it is easily seen or felt. It often attains a considerable size without any lameness, while in other cases the lameness is severe with but a very small growth. An animal with a splint may walk without any lameness, but if watched closely, the affected leg can be seen carried forward less bent than the sound one. When he is trotted the lameness is very plain; he drops the body when the weight is thrown on the sound leg, and elevates the body when the weight is thrown on the affected leg. By rubbing the leg with the hand, an enlargement may be felt, and pressure on the enlargement causes pain. Or, if you can not feel it, you may detect the tenderness by gently tapping the leg with a small stick.

TREATMENT.—Rest the animal, and apply cold water for an hour at a time, three or four times a day, for two or three days, and then blister with biniodide of mercury. (See Index.) A splint seldom does harm, unless it is close to the joint.

Ringbone is a bony growth or enlargement near the pastern-joint. If it does not affect the joint, it is not a serious trouble. But if it does, a complete stiffening of the joint often results.

CAUSES.—Breeding colts from parents that have ringbones; hard or fast work; or any injury to one leg causing the other to bear the weight intended to be borne by both; this will produce ringbone on the sound limb. Another prolific source of ringbones is allowing sucking colts to follow their mothers when at work.

SYMPTOMS.—Lameness, which in most cases precedes the enlargement. Sometimes heat and tenderness can be detected just above the hoof; and bending the pastern-joint may cause pain. If it affects the os pedis—the bone inside of the hoof—the weight will be thrown on the heel as in laminitis, and in this last case the hoof tends to grow in rings, and become long at the toe.

TREATMENT.—If the foot has grown out of shape, get it into shape by properly trimming it; then bathe in hot or cold water until the heat and tenderness partly subside; then blister with biniodide of mercury. (See Blistering.)

Side-bones.—This is a state in which the cartilages of the heel—lateral cartilages—change from cartilage to bone—ossify—and also become enlarged. This is more serious in a fast than a heavy horse, as it interferes with traveling; but it interferes much less with slow work.

TREATMENT.—Cut the lower part of the hoof away just under the cartilages; bathe, or poultice for a few days; then blister around the top of the hoof with biniodide of mercury. (See Index for Blistering.)

Bone-spavin is a bony growth on the lower, inner part of the hock-joint. There are two kinds of spavin. One is on the surface of the joint, and the other is more deeply situated, and is often so hidden that the eye can not detect any enlargement. A blister will generally relieve the former, while it will not relieve the latter. A spavin high up on the joint is much more serious than one low down.

CAUSES.—Breeding colts from spavined parents. Horses with narrow hocks from front back, and having a long point to the hock-joint, are more liable to spavin than those with well-formed hocks. Other causes are: hard, or fast work, especially if worked on hard roads; a severe sprain; or an injury to one hind-leg, causing the sound leg to maintain the weight intended for both, often causes it on the sound leg. High heeled shoes sometimes cause it.

SYMPTOMS.—If there is an enlargement on the joint it is easily seen. The lameness is most readily detected when the animal is first brought from the stable, for the lameness often partly or entirely disappears after slight exercise. There are also some cases that show no enlargement whatever, and others that manifest lameness before the enlargement appears. In examining, always compare the two legs; look at them from behind, and from between the fore-legs; stand a little to one side of the horse near his head and look at the leg on that side, then change over and in the same way look at the other leg. Rub the legs with the hand and compare their relative size and shape, and see if there is heat in either leg. Some severe cases affect the entire leg, and cause a wasting of the hip. This last

misleads many. Notice the foot or shoe, the greatest wear will be at the toe. Turn him from side to side, and notice the action of the two hocks, for in slight cases you will have to judge to a great extent by the action. When the animal rests he will bend the limb some. Take hold of the foot and forcibly bend the hock-joint, and then trot him some, and notice whether it increases the lameness; if it does, it is a symptom of spavin.

TREATMENT.—The joint can not be restored to its natural condition, and there is no certainty about relieving the lameness. The best method of procedure is to allow rest; and if the feet are out of shape, trim them and get them as nearly their natural shape as possible. It is best to turn the animal loose in a large stall; it is even better than at pasture. If there is much heat and soreness in the part, bathe well with hot or cold water until the soreness subsides, and then apply the biniodide of mercury blister. (See Blisters.) Or, burn it with a firing iron at a white heat, and blister in about eight days after firing. Firing is said to be the most potent remedy, but unless it is carefully used it is liable to blemish.

Collar-galls.—Collar-galls are caused by pressure of the collar. Similar sores may be caused on other parts of the body by pressure of the harness, saddle, etc.

TREATMENT.—Remove the pressure, bathe well with water, and then apply the white lotion. (See Index.) Or,

Take—Vaseline,	1 ounce.
Iodoform,	5 grains.
Fluid Extract of Geranium,	10 drops.
Carbolic Acid, pure	15 grains.

Mix thoroughly, and apply as an ointment two or three times a day.

When an abscess forms from such an injury, it should be opened and treated as an abscess. If a hard tumor forms, the quickest way of curing it is to cut it out, but it may be reduced or removed by applying the iodine ointment or a biniodide of mercury blister. (See Index.) Sometimes such injuries terminate in sitfasts, which consist of small portions of skin, which adhere to the flesh in their centers, but their edges are detached

and surrounded by an angry-looking sore. The treatment is to cut these pieces of skin out with a knife and then treat with the white lotion or the ointment already given.

Saddle-galls.—TREATMENT.—Remove the cause; bathe the part in warm water, or poultice until thoroughly softened and cleansed, and use the white lotion two or three times a day. (See White Lotion.) Or,

Take—Corrosive Sublimate,	. . . . .	12 grains.
Water,	. . . . .	4 ounces.
Or—Sulphate of Copper	. . . . .	15 grains.
Water,	. . . . .	1 ounce.

Use either of these the same as the white lotion.

Saddle-galls may terminate in a sitfast, which is a scab loose around its edges, and firmly adherent in the center. Cut it out with a knife and then treat as above.

Poll Evil—Is an abscess on the top of the neck near the head.

CAUSES.—It is usually caused by some injury, as striking the head against something, tight reining, wearing a yoke or heavy halter, or any cut or other injury to the part.

SYMPTOMS.—More or less swelling. The animal carries the nose out, the top of the neck is hot, and pressing on it causes pain. If it has been present for any length of time, pipes—sinuses—form. These sinuses may extend in any or in many directions.

TREATMENT.—If it is noticed before pus is formed, treat it just as an ordinary abscess. (See Abscesses.) Keep the animal's head tied up, and feed him from a trough and manger which are high, so the muscles of the neck will not have to move much. If the heat and soreness disappear, and the skin remains thick and hard,

Take—Iodine,	. . . . .	2 drams.
Iodide of Potash,	. . . . .	2 drams.
Lard,	. . . . .	1 ounce.

Mix, and apply once or twice a day. When pus is formed a free opening should be made, and if it is opened early, sinuses will seldom form. After it is opened it should be thoroughly

syringed with tepid water or the carbolic lotion (see Index), and then

Take—Water, 1 ounce.
Corrosive Sublimate, 5 grains.

Mix, and use as a wash two or three times a day. But when sinuses are once formed the case becomes more difficult, yet it may be cured by rolling five or six grains of corrosive sublimate in tissue paper, and pushing it down into the sinuses, which will cause sloughing in six or eight days. Or a crystal of nitrate of silver, five or six grains in weight, may be used instead of the above, with similar results. But the most certain and most satisfactory treatment is, to use a knife and carefully follow and cut these sinuses to their bottoms, and then syringe with the corrosive sublimate and water, as already given; or

Take—Chloride of Zinc, 40 grains.
Water, 1 ounce.

Mix, and use with a syringe two or three times a day. If water can be so placed that it will run upon the part for an hour or two each day, it will be of great benefit. If this can not be done, the sore should be thoroughly cleansed with water two or three times a day. If the animal is weak, or if the legs swell,

Take—Sulphate of Iron, 1 ounce.
Gentian Root, powdered, 2 ounces.
Cinchona Bark, powdered, 1 ounce.

Mix; make into eight powders, and give a powder three times a day. Give plenty of good, easily digested food.

Fistula of the Withers.—This is an abscess on the withers, which, if allowed to progress, forms sinuses or pipes, and until these form it is not really a fistula.

CAUSES.—Any injury to the parts. The most frequent cause is a misfitting saddle.

SYMPTOMS.—Heat, pain, and swelling, as in an abscess, and if it is treated as an abscess in the start, sinuses may be prevented. After sinuses are formed there is a continual flow of pus, and if any bones are affected the pus has a very peculiarly offensive smell.

TREATMENT.—Just the same as for poll evil (which see). Use the knife pretty freely. Caustics and blisters will sometimes relieve a mild case; but the knife is safer and more certain, less severe, and causes the sore to heal much more quickly than when caustics are used. If, when cutting, you can make your opening at the lowest part, it is much better, but if it passes down inside of the shoulder-blade this is very hard to accomplish. After opening, the parts should be thoroughly cleansed, and then syringed with

Corrosive Sublimate,	. . . . .	15 grains.
Water,	. . . . .	1 ounce.
Or—Carbolic Acid, pure,	. . . . .	2 drams.
Water,	. . . . .	1 pint.
Or—Chloride of Zinc,	. . . . .	40 grains.
Water,	. . . . .	1 ounce.

Use any of the above two or three times a day, after cleansing thoroughly each time. And be sure to keep the outside opening from closing or healing up, until the inside has healed.

Sweeny—Shoulderslip.—This is a strain of the muscles of the shoulder, and from a very peculiar bulging of the shoulder-joint when the animal walks, it is called shoulderslip.

CAUSES.—It is most common in young animals, when first worked to a plow or harrow, the jerking and jarring causing sweeny. Sometimes it is caused by a wagon striking a stone or other obstacle, and causing a jar. Or it may be caused by jumping, slipping, or even by rolling in a stall.

SYMPTOMS.—Usually the first thing noticed is wasting of the muscles of the shoulder, or an impaired action, which action does not amount to lameness. In six or eight days it shows plainly. The joint bulges when weight is thrown on it until you might almost think the shoulder was partially dislocated.

TREATMENT.—Rest the animal for three or four weeks, turn him loose in a large box-stall; this is better than turning him out to pasture. When first injured bathe for three or four days with warm water, and then

Take—Tincture of Camphor,	. . . . .	2 ounces.
Tincture of Opium,	. . . . .	2 ounces.
Tincture Arnica,	. . . . .	2 ounces.

Mix, and bathe the parts with it two or three times a day. And blister about once every two weeks with

Cantharides, powdered,	. . . . .	1 ounce.
Lard,	. . . . .	8 ounces.

Mix, and in preparing this it must not be heated hot, but just warm enough to melt the lard. (See Blistering.) After the shoulder begins to fill up, light saddle or buggy work is of benefit, but the animal should not be put to the plow, harrow, or wagon.

Puffs, also known as *Windgalls* and *Bursal Enlargements*. These are puffy tumors or enlargements near any joint, but are called windgalls only when situated on or near the fetlock-joint. They sometimes become cartilaginous, or bony. If they are soft, without heat or pain, they seldom do any harm.

TREATMENT.—If they are of long standing they are incurable, but if treated in the early stage they may be reduced. If they are suddenly produced in a healthy, fat animal, give five drams of pulverized aloes and apply cold water to the parts for an hour at a time, three or four times a day, for a day or two, and, after bathing, each time, place some tow or cotton on the puff, and then bandage, causing the tow to press upon the puff, and then keep the bandage wet. It is not advisable to open them.

Bog-spavin is a distension of the capsular ligament of the hock-joint with synovia, commonly called joint-oil or joint-water. This capsular ligament, which is a little sack, naturally holds about two tea-spoonfuls of fluid, but in a bog-spavin it may contain ten or fifteen times as much. A bog-spavin seldom interferes with the action of the animal.

CAUSES.—Want of regular exercise, working too hard, or driving too fast; any sprain or other injury. It may come on a leg very suddenly.

SYMPTOMS.—There is a puff or enlargement on the inner front part of the hock-joint. If it is suddenly caused, by a sprain or other injury, there will be heat and tenderness, and the animal will be lame.

TREATMENT.—If it is suddenly produced in a young, fleshy

horse, it is best to reduce his weight by limiting the food; bathe well with cold water for two or three hours, and then bandage the joint, leaving the point of the hock free, or use a bog-spavin truss, and apply a high-heeled shoe. If it has been present for some time, the same treatment may be tried, but in addition thereto a cantharides blister may be used occasionally. (See index.) A bog spavin should not be cut open.

Blood Spavin.—Is an enlargement or rupture of the vein—*vena saphena*—which passes directly over the seat of a bog spavin.

TREATMENT.—Consists in applying continued pressure to the part by means of a bandage or a truss.

Thoroughpin.—This is a puffy tumor on the lower, back part of the thigh, just above the hock-joint; it can be pushed through from side to side.

CAUSES.—Over-exertion or some irritation caused by a bog spavin may cause a thoroughpin, but a thoroughpin can not cause a bog spavin.

TREATMENT.—Rest the animal, and apply cold water to the joint for a few days; and then use a bandage in such a way as to press upon the enlargement; or use a thoroughpin truss, apply a high-heeled shoe, and apply the iodine ointment (see index), and an occasional blister of cantharides. (See index.)

Curb—Is an enlargement, on the back part of the hind-leg, just below the hock joint.

CAUSES.—Sprain or rupture of the calcaneo-cuboid ligament; hard or fast work; working in deep snow or deep mud; forcibly backing a heavy load; rearing; jumping, or any thing which brings a strain upon the part.

SYMPTOMS.—An enlargement which is easily seen from the side of the animal. Curb usually causes lameness, but the lameness will get well itself if rest is given. It seldom occurs in old animals. The enlargement at first is very hot and painful. It takes a long time for complete recovery, and treatment is of little use.

TREATMENT.—Give rest, and if there is pain and heat in the part, bathe with warm water, in which, for each pint of water,

use an ounce of laudanum. After the soreness begins to disappear, clip the hair off and apply the cantharides blister.

Take—Cantharides, powdered, 1 dram.
Lard, 6 drams.

Mix, but do not heat more than just sufficiently to melt the lard; if it is heated to boiling it will not act. For directions for applying see Blistering.

Laminitis, Acute.—Also known as *Inflammation of the Sensitive Laminæ* and *Founder*. It is an inflammation of the sensitive laminæ, but there are other structures also affected.

CAUSES.—Some feet are predisposed to this disease, but it may be produced in any kind of a foot, and when caused suddenly in a very good foot, it is more severe than when in a poor foot. Hard work and fast driving are common causes. It is most common in hot weather. Shoeing is said to be a cause, and perhaps it is, in some cases. Food sometimes causes it. A small amount of wheat is often sufficient; any kind of food, or any thing that will irritate the intestines. Foaling sometimes causes it by the irritation thus caused. It can be readily produced by driving a horse in hot weather until sweating, and then allowing him to stand where the wind will blow on him and cool him too quickly.

SYMPTOMS.—There will be fever and a full, strong pulse, fifty or sixty beats per minute, sometimes seventy, and the entire body may be bedewed with sweat. The animal is stiff and moves with the greatest difficulty, and shows some symptoms of some disease of the internal organs. He usually persists in standing, but sometimes lies down. When forced to back, he throws the weight of the body on his heels, and will even drag the feet. Around the hoof there will be great heat, and the arteries near the hoof can be felt pulsating. If only the fore-feet are affected, which is usually the case, he puts the hind-feet forward under the body, to take the weight from the sore feet, and when compelled to move, he goes in a kind of jumping manner, trying to keep the weight on the frogs of the feet. But when all four of the feet are affected, the symptoms will be different; yet he stands with the hind-feet pretty well forward,

and keeps the fore feet close together, and when weight is thrown on one foot, it is suddenly jerked up, almost as in string-halt or other nervous troubles. When it occurs in one foot only, it can usually be traced to some injury; as, one leg being disabled and the sound one being compelled to bear too much weight, causes it in the sound foot. If it occurs in both hind-feet it can often be traced to having been driven on hard roads, without shoes. But when it is caused by some derangement of the stomach, it either attacks both fore-feet or all four of the feet. Sometimes the bones of the feet descend and make the bottoms of the feet convex, and thus cause what is called "Pumiced Foot," or, in more severe cases, the bone descends right through the sole of the foot. In such cases the hoof grows in a very bad, almost shapeless mass. If an attack is mild and allowed to continue, all these conditions may occur.

TREATMENT.—Remove the shoes, rasp the horn of the hoof away until it is considerably thinned, and then poultice the whole foot by making a sack of strong cloth or leather, large enough to pass over the foot, then fill up with a warm poultice and secure the sack around the leg, but not too tightly. Then, if the attack is not caused by an overdose of physic or diarrhea, give eight drams of aloes; and if the pain is very severe, give with the aloes one dram of powdered opium, and give injections of soap and warm water freely. If the fever is great, give tincture of aconite-root, twenty drops, largely diluted in water. every two hours, until relieved. Bleeding is good in many cases, and if blood is taken, do not give so much physic. In all cases nitrate of potash should be given, in four dram doses, three times a day, in the feed, drinking water, or in a drench of cold water; always allowing plenty of cold water, in small quantities at a time, until the physic begins to operate, after which it should be given sparingly for awhile. When these remedies do no good, it is probable matter is forming in one or more of the feet, and, in some cases, it becomes necessary to make an opening at the toe by cutting away the hoof, allowing the matter to run out; and if this is done in time, it may prevent the descent of the bone as already described. When the

medicines take effect and give relief; the animal should be moderately exercised in three or four days, if it does not cause too much pain.

Laminitis, Chronic.—This disease is more liable to attack aged horses, but it may attack any horse.

CAUSES.—The causes are similar to those in Acute Laminitis.

SYMPTOMS.—The symptoms are somewhat similar to those of an acute attack, but they are more obscure. There will be heat in the feet, and the horse, when walking, goes in a kind of stumbling gait, and endeavors to throw the weight on the heels, and in attempting to do this the toe is thrown up and the heel is thrown down, which gives the animal a very peculiar and awkward appearance. Although there may not be much pain, and the animal may work pretty well all the time, yet the muscles of the chest waste away (if it is in the fore-feet), and give rise to what is called chest founder, or it may terminate in pumiced foot. However, there is no such a disease as chest founder.

TREATMENT.—Treating this disease is very tedious, and not very successful. Dissolve four to six drams of aloes in hot water and give when cool. In most cases the shoe should be taken off, and the outside of the hoof, at the heels, should be rasped off; then poultice the feet, or stand them in a tub of water, or it will do to stand the feet in wet clay. If clay is used it should be pure and clean, and renewed when it becomes filthy. After the heat and tenderness subside, apply a bar shoe, which should be thinner at the heel than at the toe; but if the soreness continues, apply a cantharides blister around the top of the hoof, but not in the hollow of the heel. (See Blisters.) If it is in the spring of the year, turning him on a wet pasture is of great benefit.

Navicular Disease.—Also called *Navicularthrititis* and *Coffin Joint Lameness*. This disease is situated in the joint inside of the hoof.

CAUSES.—Hard and fast work. A very upright pastern is more liable to it than the opposite, especially if the animal has

a short, stubby gait, or very high action, the latter causing the feet to strike the ground too forcibly; allowing the toes to grow too long, or cutting the heels too much when shoeing; or any injury to the back part of the foot.

SYMPTOMS.—Lameness, in some cases sudden and severe, in others gradual and slight, sometimes continuous, and sometimes periodic. Sometimes an animal goes lame when first taken from the stable, but soon goes sound when exercised. When the disease is firmly established, and in but one foot, the diseased foot is rested in front of the sound one. If both are affected, he throws the weight from one foot to the other, and when first taken from the stable he goes with a kind of stilty action, and from this action it has been called grogginess. The muscles of the shoulder waste, and from this fact it is often called sweeny. There is also contraction of the foot, which is easily seen if but one foot is diseased. Pressure in the hollow of the heel against the tendon causes pain. The foot is usually greatly worn at the toe, and the front of the hoof is more rounded than natural.

TREATMENT.—If it is severe and of long standing, it is incurable, but if recent and mild, a cure may be effected. Take off the shoe, rasp down the toe and also the wall of the hoof, and in some cases even thin the bottom of the hoof some; then use poultices or bathe well with water, or keep him standing with the foot in water three or four hours a day, and when the heat and pain seem better, blister around the top of the hoof with the biniodide of mercury-blister. (See Blistering.) If it is in the spring of the year when the ground is wet, turn the animal on pasture. If remedies fail, and the horse becomes useless, the only relief then is to divide the nerves which give sensation to the foot; and as such an operation would require a practical veterinary surgeon, it will not be described here.

Corns.—These are simply bruises caused by pressure from the shoe. There are hard, soft, and suppurating corns, but these are only different stages of the same disease.

SYMPTOMS.—More or less lameness; and if only one foot is affected it will be rested in front of the sound foot. If both

feet are affected, the weight will be frequently shifted from one foot to the other. The animal travels better on soft ground, and a rider or other weight on his back increases the pain. He sometimes knuckles at the fetlock; this misleads many. When the shoe is removed and the foot pared at the heel, redness can sometimes be seen, but sometimes there is lameness without redness.

TREATMENT.—Remove the shoe, cut down the heel, and toe too, if necessary, in order to put the foot into proper shape. Do not cut to the quick unless matter is present, but cut just enough to relieve the pressure, and replace the shoe in such a manner that it will not press upon the bruised place. If there is much soreness it is sometimes necessary to poultice the foot, or keep it standing in water. If matter is formed, cut down to it, and let it out. If it is not let out it will work its way out at the top of the hoof.

Punctures.—By this is meant any injury from nails, snags, etc., passing through the bottom of the foot. If it is in the frog it is more liable to become serious than if nearer the toe.

SYMPTOMS.—If the injury can not be seen, the action of the animal must be a guide. If it is in a hind-foot the fetlock will knuckle when he is first started, after a rest. If it is in a fore-foot, the affected foot will be rested in front of the sound one; and in either case, when weight is thrown on the sore foot, it is suddenly shifted back to the sound one. In examining, take up the foot and tap it with a light hammer, and when the sore part is struck he will flinch. Pare the bottom of the foot down until all dirt and old horn is removed, and the point of injury may then be seen.

TREATMENT.—First, satisfy yourself that no piece of the offending body remains in the foot. Rest the animal, and if the hole be too small to allow the blood and matter to escape, cut the hoof away until you make a free opening. Then, by means of a sack large enough to admit the foot, apply a poultice—bran, hops, or flax-seed meal is good—and tie the sack around the leg. Sometimes the entire frog comes loose; it then becomes necessary to cut it away and allow a new one to grow in.

Sometimes, in such a case, there appears an unnatural growth which must be removed, either with a knife, a hot iron, or with caustics. If caustics are preferred, take a stick of nitrate of silver, and rub it thoroughly over the growth, or dust the growth with powdered blue vitriol, or pure carbolic acid. Apply any of these once or twice a day, until the growth is subdued. Then use

Carbolic Acid, pure,	. . . . .	3 drams.
Water,	. . . . .	1 pint.

Bathe with this three or four times a day.

The above treatment applies to gravel in the feet also.

Bruises.—**SYMPTOMS.**—Heat, pain, and swelling in the parts.

TREATMENT.—Just the same as for abscesses; first prevent the formation of matter in the part, and, failing in this, hasten its formation, open and let it out. (See Abscesses.)

Abscesses.—An abscess is a gathering or boil. It may come from some recognizable cause, or seemingly without a cause. As a rule, an abscess is easily detected, but in some cases when near a joint, it is difficult to say whether it is an abscess, a puff, or bursal enlargement.

SYMPTOMS.—There will be heat, pain, and swelling, with a throbbing or beating in the part. After awhile the hitherto hard, unyielding tumor becomes soft near the center, the hair falls off and leaves a bare spot; and by placing the fingers of one hand on the lowest part of this soft portion, and tapping above them with the fingers of the other hand, a sensation is communicated to the fingers like that from so tapping a bladder filled with a fluid. An aneurism (which is a tumor caused by the walls of an artery becoming enlarged or ruptured), has been mistaken for an abscess. When any doubt exists, it is best to use an aspirator needle (which is a small tube made sharp so as to cut through the flesh). Introduce this needle, and if pus is drawn out, it is surely an abscess and should be freely opened.

TREATMENT.—If you think an abscess is about to form, remove any splinters or other causes, and apply cold water to the part to prevent if possible the formation of matter. But if you fail in preventing its formation, use just the opposite treat-

ment, viz: hot water, hot poultices, etc., to hasten its formation, and then open it at the lowest point. The direction of the cut should usually be made in the direction of the folds of the skin, unless you are to cut deep enough to injure a muscle, in which case cut lengthwise with the muscle. But never cut across arteries, veins, or nerves, unless it is absolutely impossible to avoid it. In opening an abscess on an animal's belly, always think of a rupture, as it is easy to mistake the one for the other, and opening a rupture would be a very serious matter. After an abscess has been freely opened, keep it open and syringe it thoroughly with the carbolic or white lotion. (See Index.) Wash it thus, once or twice a day.

Lampas.—This is very common in young horses; and it is called a disease, but it is not certain whether it should be called a disease or not. Sometimes the gums become so swollen as to be level with, or even extend above, the teeth. In such a case it may be necessary to make two or three cuts in the gums, being careful that you do not cut above the third bar, or you will have profuse hemorrhage. Then feed soft food for a few days. Washing the mouth with

Alum,	. . . . .	4 drams.
Water,	. . . . .	1 pint.

three or four times a day is beneficial. The brutal practice which was and is still sometimes resorted to of using a hot iron, is entirely unnecessary, and should always be condemned; and cutting with a knife is very seldom necessary.

Wolf-teeth.—These teeth occur just in front of the first grinders. In some rare cases they cause trouble; yet it is not determined that such teeth have any thing whatever to do with causing eye troubles. Such teeth are of no use, and may be removed with a pair of forceps; or a punch or large nail may be placed against the tooth, strike the nail or punch with a light piece of wood, and thus knock it out. The forceps are best, as knocking them, often breaks them off. A heavy piece of wood or a hammer should not be used, or the first grinder may be injured.

General Indigestion.—This is a very common trouble; and the animal affected likely eats well; but his food does him

no good; or he will eat well at times, and refuse food at other times. Or he may have a depraved appetite, eat his bedding or lick the white-wash from the walls, if any is in reach.

SYMPTOMS.—The skin is drawn tight over the body, and the hair stands on end. There are symptoms of general weakness. Sometimes there is a diarrhea, at other times costiveness. The eyes present a dull appearance, the lining of nose, mouth, and eyes, is of a pale or whitish color. There is an offensive smell from the mouth, and also from the dung. The animal is easily fatigued; and if he is greatly weakened, the limbs, and even the belly will swell. The heat of the body, the pulse, and the breathing, are natural, or nearly so.

TREATMENT.—Feed on easily digested, but nourishing food; and give a variety of foods. And

Take—Bicarbonate of Soda,	2 drams.
Gentian, powdered,	4 drams.
Nux Vomica, powdered,	$\frac{1}{2}$ dram.

Mix, and give at one dose twice a day. Give in the food if it will be so taken; if not, give in any way you think best. If the animal is greatly weakened, and the pulse weak, give the foregoing for two days; and then

Take—Gentian,	6 ounces.
Sulphate of Iron,	$1\frac{1}{2}$ ounces.
Nux Vomica,	$1\frac{1}{2}$ ounces.
Digitalis Leaves,	$\frac{1}{2}$ ounce.

Powder all, mix, and give one tablespoonful at night in the food, or any way most convenient. If these do not benefit, then give nitric-acid, one-half fluid dram in the water, three times a day.

Spasmodic Colic is a spasmodic contraction of any part of the intestines.

CAUSES.—Same as in flatulent colic.

SYMPTOMS.—It comes on very suddenly. The animal begins to paw, looks at the sides, and throws himself violently to the ground. (In inflammation of the bowels, he lies down more carefully.) He tries to lie on the back; gets up; may shake himself and appear well for a short time; may even eat some-

thing; and again be seized with pains as bad as before, or worse. In some cases the body is wet with sweat. Small lumps of dung may be passed; attempts are frequently made to pass water; and it is a good sign to see him pass water freely. The pulse, during the pain, may be as fast as sixty beats per minute, and fall to forty-five during the periods of ease. (In inflammation of the bowels, the pulse begins at about forty-five and gradually increases.) Pressing on the bowels causes pain in inflammation of the bowels, and gives relief in colic. Colic usually runs its course in from eight to twelve hours; but a mild case may last longer.

TREATMENT.—As almost every veterinary surgeon has his favorite prescription for this disease, I will give several:

Take —Sweet Spirits of Niter,	2 ounces.
Fluid Extract of Belladonna,	2 drams.
Water,	2 ounces.
Or —Sweet Spirits of Niter,	2 ounces.
Laudanum,	2 ounces.
Water,	8 ounces.
Or —Aqua Ammonia,	4 drams.
Turpentine,	2 ounces.
Raw Flaxseed Oil,	1 pint.
Or —Sulphuric Ether,	1½ ounces.
Laudanum,	1½ ounces.
Fluid Extract of Belladonna,	1 dram.
Spirits Camphor,	½ ounce.
Raw Flaxseed Oil,	½ pint.

Mix. Give any one of the foregoing at one dose, and if no relief is given in a half hour,

Take —Barbadoes Aloes, powdered,	6 drams.
Sulphuric Ether,	1 ounce.
Laudanum,	1 ounce.

Mix, and shake for a few minutes, and then add six ounces of raw flaxseed oil, and give at one dose. If still no relief in a half hour more, repeat any of the foregoing in one-half the amounts given, leaving out the oil and aloes, and give in water. Give every half hour until relieved. Give injections of warm

water, and apply blankets wrung from hot water to the bowels. Rubbing the belly well with the hand is beneficial. A little walking exercise is also beneficial, but trotting or running exercise is highly injurious.

Flatulent Colic is a distention of the intestines with gases.

CAUSES.—Poor food, green food, green or partly dried clover hay, changing from one kind of food to another too suddenly, feeding too soon after being over-heated, etc, or after severe and protracted exertion.

SYMPTOMS.—The pain is constant but less severe than that in spasmodic colic. The belly is more or less swollen, and gives a drum-like sound when struck. The head is turned to the side. The animal paws, rolls, and lies down; and may lie still for a short time; tries to roll upon the back; sometimes backs into a corner and remains there for awhile. He moves and lies down more cautiously than in spasmodic colic. The breathing is quickened; and, in a case that is likely to prove fatal, there is an anxious look, the pulse becomes weak and irregular, and the lips are drawn back, showing the teeth.

TREATMENT.—Give injections freely.

Take—Warm Water,	. . . . .	$\frac{1}{2}$ gallon.
Turpentine,	. . . . .	1 ounce.
Common Salt,	. . . . .	1 ounce.

Or, if a syringe can not be obtained, remove the dung as far as you can reach with the hand.

Take—Laudanum,	. . . . .	2 ounces.
Aromatic Spirits of Ammonia,	. . . . .	1 ounce.
Flaxseed Oil, raw,	. . . . .	$\frac{1}{2}$ pint.

Mix, and give at one dose.

Or, take—Turpentine,	. . . . .	2 ounces.
Laudanum,	. . . . .	1 ounce.
Fluid Extract Belladonna,	. . . . .	1 dram.
Raw Flaxseed Oil,	. . . . .	$\frac{1}{2}$ pint.

Mix, and give at one dose. If there is no relief in a half hour, repeat the dose.

If no relief is experienced in another half hour,

Take—Boiling Water, 1 pint.
 Aloes, powdered, 4 drams.

Mix, and when cool, add

Laudanum, 1 ounce.
 Aromatic Spirits Ammonia, 1 ounce.

and give at one dose. If these fail, any of the doses given may be repeated. If the last is given again, leave out the aloes.

When the above remedies fail, the only thing that can be done is to puncture and let the gases escape. For this operation a common trochar and canula, about four inches in length, should be used. Puncture in the right side, at an equal distance from the haunch-bone, the last rib, and the projections from the back-bone, directing the instrument a little downward and a little backward; draw out the trochar and leave the canula in until the gases cease to flow. If the tube should get stopped, it can be opened with the trochar. The instrument named above can be bought through your druggist, or from any surgical-instrument maker. When such an animal begins to recover, he should be carefully used for some time, and fed such food as is easily digested. And give the following powders for a few days:

Take—Bicarbonate of Soda, 1 ounce.
 Fenugreek, powdered, 1 ounce.
 Gentian, powdered, 1 ounce.
 Ginger, powdered, 1 ounce.
 Rhubarb, powdered, 1 ounce.

Mix, and make into six powders, and give one three times a day.

Worms.—As space will not permit, we can not trace the causes of worms here.

SYMPTOMS.—The best and only unmistakable symptom to be seen is the worms in the dung. But there are other signs. The small needle, whip, or rectum worms, which infest the last part of the intestine, cause the animal to scratch and rub the tail. And by raising the tail, you can see a yellowish-white

substance adhering around the anus. This is the eggs of the worms, but can only be positively identified by the use of a microscope.

TREATMENT.—The simplest, and often the most successful treatment for rectum worms, is frequently repeated injections of a strong tea, made by boiling equal parts of quassia chips and gentian root, in water, and inject it when cool. If this should fail, then give medicines as for the large worms, as follows:

Lumbrici are large worms, which resemble common earth-worms in size and shape. These are found in the small intestines, and sometimes in the stomach. If but few are present, they do little or no harm, but if great numbers are present, they sometimes cause uneasiness and pains similar to colic. When any of these worms are passed, it is time to attend to the animal.

TREATMENT.—Feed but little for a day, and then give one of the following, which are compiled and arranged from Finley Dun's Veterinary Medicine:

Take—Barbadoes Aloes, powdered,	$\frac{1}{4}$ ounce.
Assafoetida,	$\frac{1}{4}$ ounce.
Boiling Water,	1 pint.

And when cool, add

Sulphuric Ether,	1 ounce.
Turpentine,	1 ounce.

Give at one dose, and repeat every morning for three or four days.

Or, take—Assafoetida,	2 drams.
Calomel,	$1\frac{1}{2}$ drams.
Savin,	$1\frac{1}{2}$ drams.
Oil of Male-shield Fern,	30 drops.

This can be made into a paste with molasses and linseed-meal. Give at night at one dose, and the next morning

Take—Barbadoes Aloes,	4 drams.
Boiling Water,	1 pint.

Mix, and give at one dose, when cool.

Diarrhea—Scours.—**CAUSES.**—Too much food, food which is too rich or too watery; frozen turnips, beets, cabbage, etc.;

impure water; or any irritant in the food, as irritating vegetables, or sand on the grass or hay. If diarrhea is not checked in time, it may terminate in inflammation of the bowels.

TREATMENT.—All that is required in many cases, is to change the food; but medicine is sometimes necessary. First ascertain the cause, if possible, and remove it. If the cause should be sand or clay, giving a medicine to stop the diarrhea would be very injurious until such foreign matters are removed from the bowels. In such a case, first give a slight physic, as,

Take—Raw Linseed Oil,	. . . . .	1 pint.
Laudanum,	. . . . .	$\frac{1}{2}$ ounce.

Mix, and give at one dose. Or

Take—Aloes, powdered,	. . . . .	2 drams.
Gentian, powdered,	. . . . .	2 drams.
Ginger, powdered,	. . . . .	2 drams.

Mix, and give at one dose in a pint of warm water. But after the diarrhea has continued of itself for some time, the above may not be necessary; and when the bowels have acted pretty freely, either with or without physic, it becomes necessary to check it.

Take—Catechu, powdered,	. . . . .	4 drams.
Gentian, powdered,	. . . . .	2 drams.
Ginger, powdered,	. . . . .	2 drams.

Mix, and give at one dose in tepid water. If not relieved in twelve hours, repeat the dose. Or, instead of the above, you may use this:

Take—Turpentine,	. . . . .	1 ounce.
Opium, powdered,	. . . . .	1 dram.

Mix with three eggs and give at one dose. Wheat-flour will cure some mild cases. If it is caused by an over-dose of physic, give—opium, powdered, 1 dram in tepid water, and repeat in four or five hours. Never resort to strong medicines at first, always give time for any irritants to be passed from the bowels, and then resort to treatment.

Enteritis—Inflammation of the Bowels.—This is a very fatal disease. It is an inflammation of the intestines;

usually of the mucous or lining coat; but sometimes all the coats are affected. It often causes death in six or eight hours, and seldom lasts longer than twelve hours.

CAUSES.—Colic sometimes terminates in enteritis, although some say it never does. Other causes are, too much food, or some food the animal is not accustomed to eating; in short, any thing that will irritate the intestines. Sometimes a dose of physic will cause it. Stagnant water may cause it. Driving an animal until exhausted and standing him in the cold may cause it. It may be brought on by any thing which causes great weakness.

SYMPTOMS.—These are something like those of colic and other painful bowel troubles. In inflammation of the bowels there is generally a period of dullness preceding the pain—not so in colic. Then the animal begins to paw in a peculiar manner; he may paw for hours. The belly is tucked up; he looks at the sides. These are all symptoms of colic; but in colic they are not so gradual. Early in the disease the pulse is not much affected—about forty or forty-five beats in a minute, but full and hard. The mouth, ears, and legs are hotter than natural. The pain still gradually increases. He begins to move his legs, cringes, and lies down (but more carefully than in colic), and gets up, but does not stand as in spasmodic colic; but turns around perhaps two or three times, and lies down again. There are no periods of freedom from pain, as in spasmodic colic. The eyes about this time have a very peculiar luster; they become red. The lining of the nose also becomes red. The ears and legs may now be either hot or cold, or alternately hot and cold; and the bowels costive, although they may have been loose at first, and if any small pellets of dung are passed, they are covered with mucus or slime. Frequent attempts are made to pass water, and a small amount may be passed. Pressure on the belly causes pain; but in colic it affords relief. The pulse may now run up to eighty or one hundred and twenty per minute.

TREATMENT.—Treatment is seldom successful. Give powdered opium, in one dram doses every hour, until four or five doses are given, unless relieved sooner. And give twenty drops of

tincture of aconite-root in a tablespoonful of water every two hours until the fever begins to subside, which can be determined by the pulse getting either slower or weaker. Give injections of warm water to each gallon, of which add two ounces of laudanum. Apply blankets wrung from hot water to the bowels, just as hot as can be borne by the animal, and place a dry blanket on the outside of them. Stimulants are of great benefit when the animal becomes weakened.

Take—Sweet Spirits of Niter, 1 ounce.
Ale or Beer, 1 pint.

Mix, and give at one dose; or whisky, one-fourth pint, may be used instead of the ale or beer. If whisky is used, add one-half pint of water. Do not interfere with the bowels, although they do not act for some time. Keep the patient well blanketed, and rub the legs well to keep up the circulation. If signs of recovery are noticed, discontinue the use of opium.

Azoturia.—This disease is known by a variety of names, as *Partial Paralysis*, *French Stiffs*, *Kidney Disease*, *Hysteria*, *Enzoötic Hæmaturia*, etc. It is a partial paralysis of the hind quarters, rarely of the fore quarters. There is an over abundance of nitrogenous products in the urine.

CAUSES.—The causes are not satisfactorily ascertained, but it is well known that it very rarely, if ever, attacks an animal at rest, and usually attacks those that have been working, then rested, and well fed while resting, and again put to work; and in these cases it may come on in driving an animal a half-mile, or the animal may be driven three or four miles, and then be attacked very suddenly; so much so, that owners have been known to examine the feet for snags, nails, etc., thinking it impossible for the animal to become diseased so very suddenly. In other cases the disease does not develop so suddenly. Slow work is not liable to cause so severe an attack as fast driving.

SYMPTOMS.—The horse becomes sluggish, sweats too freely, becomes stiff, usually in the muscles of the loins, the breathing is increased, the pulse quick and weak, the muscles of the loins, in many cases, hard, tense, and enlarged, and in some cases the bowels are bloated. In more severe cases the symp-

toms will be more alarming; he may drop on the hind legs, stagger, and fall, or he may lie down, get up, and again lie down, showing some symptoms of colic, until he is unable longer to get up. In other cases an animal will suddenly falter, as if he had stepped on a nail or snag. In almost all cases the ears and legs will be cold, and there will be pain in the diseased parts, usually shown by the animal looking around, or by an uneasiness and inability to remain in one position. If a case is very mild, and it becomes puzzling to determine whether or not this disease is the one, stand the animal in a stall for twenty or thirty minutes, and then he will show stiffness. The urine is always of a dark red or coffee color, and if it is kept for some time in a vessel, a sediment will fall to the bottom. This disease is often mistaken for inflammation of the kidneys. If it is an ordinary attack, and proper remedies are used, the animal often gets better in a few hours, and in a few days will be well. But when the pain is very severe, the pulse quick and full, and the animal can not get up, it is an unfavorable case.

TREATMENT.—Give eight drams of aloes, dissolved in hot water; give when cool at one dose. Give injections of warm soap suds freely until the physic begins to act, and in a mild attack give sweet spirits of niter, one ounce three times a day. Apply blankets wrung from hot water over the loins, and cover them with dry blankets; or if this can not be done, you may apply one of the following :

Take—Aqua Ammonia,	. . . . .	1 ounce.
Turpentine,	. . . . .	1 ounce.
Flaxseed Oil,	. . . . .	1 ounce.

Mix, shake, and rub over the loins; or

Take—Mustard, powdered,	. . . . .	2 ounces.
Water, hot,	. . . . .	1 quart.

Mix, and when slightly warm, apply as the above.

If the water is not passed, a catheter (a long flexible tube) should be used after being well oiled. In a mare, insert the hand along the floor of the vagina, until the valve which closes the neck of the bladder can be felt, raise this, introduce the instrument carefully until the urine begins to flow. In a gelding

or stallion, the same thing is to be done, but the operation is more difficult than in a mare. Take hold of the end of the penis with one hand, and having the catheter well oiled, start it up the passage until it reaches the turn just below the anus, then have an assistant direct or turn the point of the instrument around the curve, while you push the instrument very gently until it has passed this point. When the urine is not freely passed

Take—Colchicum,	45 grains.
Vinegar,	1 ounce.
Alcohol,	2 drams.
Water,	8 ounces.

Mix, and give at one dose, and repeat every three hours until the water begins to pass. The animal will in most cases be very thirsty, and he should be given plenty of water, in small quantities but often, and just slightly warmed; keep him as comfortable as possible, and if he can not get up, turn him from side to side frequently, and as soon as possible get him upon his feet—with the assistance of slings if necessary—even though he stand but fifteen or twenty minutes.

If you have a horse attacked with this disease, do not under any consideration work or drive him longer, but get him into the nearest stable, and keep him quiet. Do not even walk him home if it is far and he is bad. Three or four drams of saltpeter three times a day is considered a cure for it, after the physic has been given; or bicarbonate of soda, in half-ounce doses, three times a day.

If the animal is suffering greatly, give

Powdered opium,	1 dram.
Or, Fluid Extract of Beladonna,	45 drops.
Or, Laudanum,	1 ounce.

And repeat the dose in two hours if necessary, until the pain subsides some, but do not give too much opium, unless the pain is severe.

Blistering.—When there is high fever in a part, or when the skin is injured, a blister seldom does any good, but often

does harm. I will quote from Williams' "Principles and Practice of Veterinary Surgery" the following: "Hints upon blistering: No more than two legs should be blistered at one time, and three weeks at least must be allowed to elapse before the others are blistered, and between the re-application. It is bad practice to blister extensively in very hot weather, and it is a mistake to suppose that blisters to the loins and back are more apt to irritate the urinary organs than when applied to any other part of the body, provided that it be carefully and properly done. . . . It is necessary to tie the horses head to the rack after a blister has been applied, in order that he may not bite it or touch it with his lips or tongue, and thus blister the mouth and blemish the spot. It is also necessary to tie the head so that the horse can not lie down, for if he lies upon the blistered limb, the vesicant (blister) will adhere to that part of the body brought in contact with it whilst the animal is recumbent, and produce an effect upon it as well as upon the part to which it has been purposely applied. If the blistered spot is in reach of the tail, the tail should be tied up, or it is apt to become daubed, and the blister whipped on the thighs, sheath, or udder. If the effects are not sufficiently apparent in about thirty hours after the blister has been applied, a very little more, or what is remaining on the skin, which may be sufficient, should be gently rubbed in; and in about forty-eight hours after the application the part is to be washed and every trace of the blister removed; a little oil being now applied, or what suits better, an emulsion of sweet oil, carbonate of potash, and water. It is a mistake to keep the parts soft too long; the eschars should be allowed to accumulate and desquamate gradually. . . . The best method is to keep the head tied up until a thick scab is formed, which will destroy the itchiness in the parts."

In pleurisy and sprains which have become chronic the *Cantharides Blister* is considered the best; made as follows:

Take—Cantharides, powdered,	. . . . .	1 dram.
Lard,	. . . . .	6 drams.

Mix, and melt slowly, never allowing it to get as hot as boiling water. A good way to prepare it is to place the vessel

containing the medicine inside of another vessel which contains water. Place this on a fire, and heat slowly until the lard melts; then remove it from the fire, and when it gets so near cold that the cantharides will not settle, stir it thoroughly, and it is ready for use.

When a bone is affected, as in spavin—a cartilage, as in side-bone—or when a ligament is chronically affected, or when a deeper and more permanent action is desired, the *Biniodide of Mercury Blister* should be used, prepared as follows:

Take—Biniodide of Mercury,	. . . . .	1 dram.
Lard,	. . . . .	8 drams.

Mix thoroughly, and it is ready for use.

There are many other compound blisters which are sometimes used, but these are the ones most frequently recommended, and almost universally used. Compound blisters are more liable to blemish than the more simple ones.

Owing to the fact that all animals are not equally affected by blister—the skin of some responding to their action more readily than that of others—these preparations do not act uniformly on all animals; in the one case the blister will have to be made stronger, and *vice versa*. A very large surface should not in any case be blistered at one time; especially with cantharides, as the cantharides is liable to be absorbed, and cause an irritation of the urinary organs. Before applying a blister, the skin should be well washed with soap and water; and it is best to clip or shave the hair off before applying the medicine; rubbing it into the parts well makes it more active. A very severe sore is not often desirable, and better results usually follow milder applications. In two or three days after a blister has been applied, the blistered surface should be thoroughly washed, and rubbed over with oil or glycerine; or the white lotion may be used. (See Index.)

In old, chronic cases, when a blister has been applied and no good results follow, it may be repeated again and again, always bearing in mind the rules given at the head of this chapter, until it either accomplishes the desired effect, or satisfies you that it will not do any good.

I will also give in this connection the *Iodine Ointment*, which is so extensively used in chronic enlargements of all kinds, especially of the glands, as in big neck, among men. This ointment is made as follows :

Take—Iodine Crystals,	4 drams.
Iodide of Potassium,	2 drams.
Oil, or Water (either),	1 ounce.

Mix thoroughly, and when the ingredients are dissolved, it is ready for use. The ointment, as given in the recipe, will cause soreness in the part to which it is applied, and for this reason it should not be applied oftener than once or twice a day, or even less frequently than this if it proves too severe. When a more gentle action is desired, as when it is desired to cause the disappearance of some collected fluid, it should be used only half as strong as given in the formula, and it may be applied oftener. The hints regarding blisters apply to the use of this in its strong form, but in a less degree to the use of the weaker preparation.

Bots.—This is not classed as a disease by modern veterinary writers, and investigation has shown that the evils attributed to the bot are purely imaginary, and the symptoms those of colic, pleurisy, etc., instead. Without doubt many valuable horses have been killed by corroding poisons, given to make the terrible “bot” let go its hold on the stomach.

Bots are the larvæ of the bot-fly, a species of the gad-fly, which lays its eggs on the hair of the horse, and which adhere to the horse’s tongue when licking himself, and are taken into the stomach. The larvæ are provided with hooks by which they attach themselves to the inner portion of the stomach, where they remain feeding upon the mucus until they undergo changes which fit them for another stage of existence, when they release their hold and pass into the bowels, and are removed with the natural evacuations. This usually occurs late in the spring. There is no evidence that they produce any pain or injury to the horse, other than to prevent proper nutrition, and the best treatment is to improve the condition of the animal by a generous supply of nutritious food.

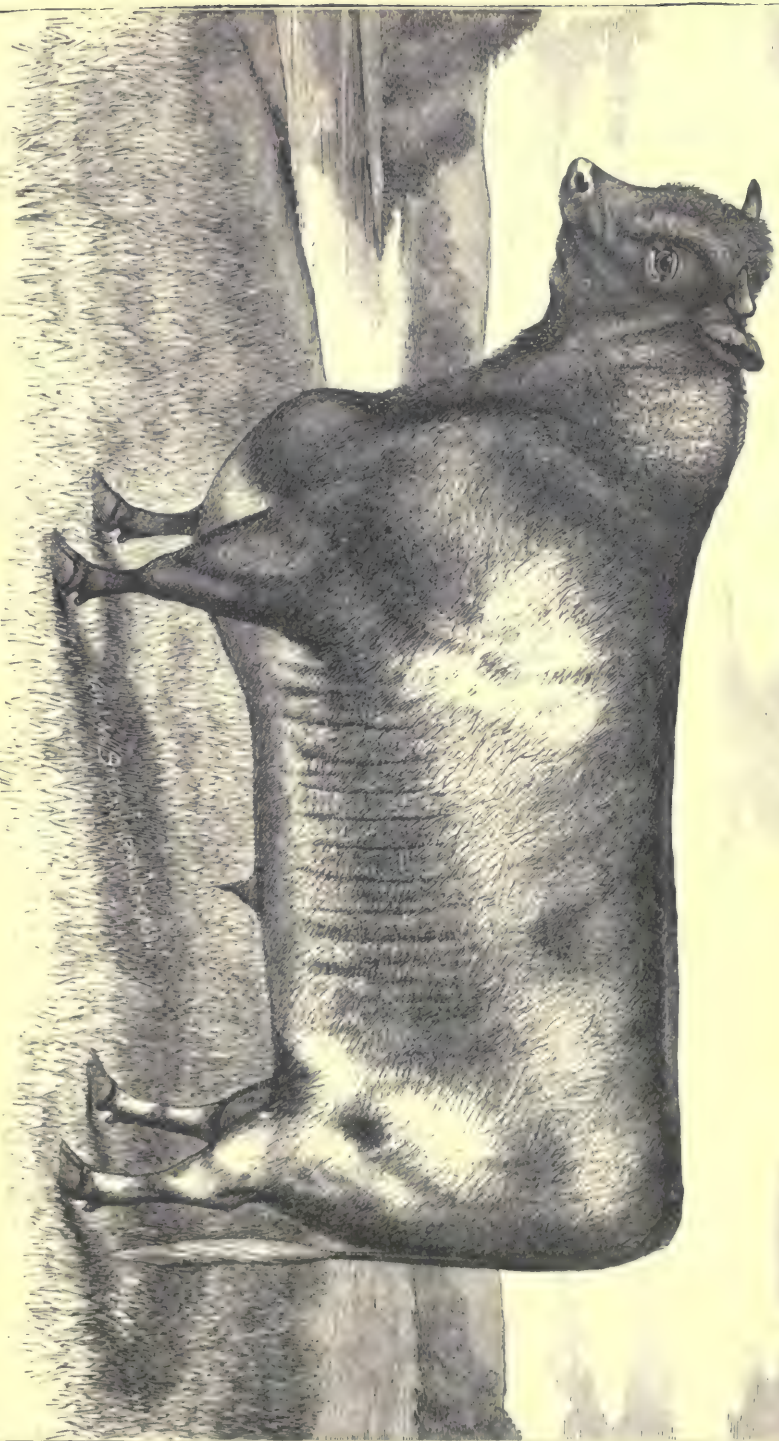
CHAPTER VIII.

CATTLE—HISTORY AND DESCRIPTION OF BREEDS.

SHORT-HORNS.—While our readers are particularly interested in the Short-horns of the present day, as found in our own country, a short sketch of the origin of the breed, as far as known, will be interesting.

The breed is of English origin, and there is no authentic record of them until the first half of the eighteenth century. Few pedigrees, if any, can be traced back further than 1740, although Mr. Thomas Bates, a distinguished Short-horn breeder, of England, in an account of these cattle, claims that they were bred on the estate of the earl of Northumberland as early as 1580. Modern Short-horns, however, trace back in direct line to the famous bull, Hubback, who was calved in 1777. This bull, who may be said to be the founder of the breed of Short-horns, as known at the present day, was bred by Mr. Turner, of Hurworth, and subsequently owned by Mr. Colling, in whose hands he laid the foundation of this celebrated breed. There is some doubt as to whether Hubback was a pure Short-horn, although "Allen," in his "American Cattle Book," claims that he was; but whether or not, he proved a most valuable stock-getter, and his descendants, Foljamb, Bolingbroke, Favorite, and Comet permanently fixed the characteristics of the breed. Comet was so highly esteemed among breeders that he sold for one thousand guineas, or over five thousand dollars.

Mr. Charles Colling was a sagacious man, and as the value of this superior breed of cattle was only known to the breeders, and their reputation as yet local, he determined to make other farmers of England familiar with them. For this purpose he took a calf got by Favorite, made him a steer, and fed him



FOURTH DUKE OF CLARENCE.
IMPORTED SHORT-HORN BULL. Property of Canada West Farm Stock Association, Brantford, Ontario.

to a bullock, for the purpose of exhibiting him through the country. Colling kept this steer for five years, and called him the "Durham Ox," and the Short-horns in this country were called by many, "Durhams." I knew them by this name, as a boy, for many years before I ever heard of the "short-horns." This "Durham Ox" weighed, at five years old, 3,024 pounds, and it was estimated that he would dress 2,352 pounds; and this extraordinary weight was due to the exceeding ripeness of his points, rather than his great size. This steer was exhibited for six years longer, or until he was eleven years old, the owner, Mr. John Day, to whom he was sold, taking him through most of the counties of England and Scotland. At the age of eleven years he met with an accident and had to be slaughtered. His hip was dislocated, in February, and he was not killed till April, and although he had lost much flesh, his weight was as follows:

Carcass,	.	.	.	.	.	.	.	.	.	.	.	2,322 lbs.
Tallow,	.	.	.	.	.	.	.	.	.	.	.	156 "
Hide,	.	.	.	.	.	.	.	.	.	.	.	142 "
												<hr/>
Total,	.	.	.	.	.	.	.	.	.	.	.	2,620 "

This steer was greatly admired, and Mr. Day was at one time offered \$10,000 for him.

Mr. Colling afterwards fed a thorough-bred heifer got by "Favorite," and sent her out on exhibition. Her profitable weight, when slaughtered (by which is meant, meat, hide, and tallow), was estimated at 1,820 pounds. Her live weight was 2,300 pounds.

The exhibition of these wonderful cattle called attention to their merits, and created such a demand for the stock that Mr. Colling soon realized a fortune from them. It also stimulated other breeders to improve their herds. The Short-horns now stand in the front rank in England and some countries on the continent adjacent, and also in the Australian and Canadian colonies. They are the heaviest beef-cattle sold in the London market, and it is claimed that they ripen at an earlier day than any others. It is also claimed that, when bred for dairy purposes, they excel for this purpose.



CANADA'S PRIDE.
GRADE SHORT-HORN COW. Property of Canada West Farm Stock Association, Brantford, Ontario.

Short-horns in America.—Soon after the close of the Revolutionary War, some cattle, supposed to be pure Short-horns, were imported to Virginia. They were well-fleshed animals, and the cows were remarkable milkers, some of them giving as high as thirty-two quarts a day. Some of the produce of these cattle, as early as 1797, were taken to Kentucky by a man named Patton, and, as little was known of breeds, they were called the "Patton stock." These cattle probably laid the foundation of the famous cattle of the "Blue-grass" country of Kentucky. Another small importation from England to New York was made in 1796, but no pure blood can be traced to these cattle.

In 1815–16 an Englishman named Cox imported a bull and two heifers into Rensselaer County, N. Y., and in 1822 another Englishman named Wayne, imported two bulls, and pure bred descendants of the Cox stock were crossed by the Wayne bulls. The stock still exists in considerable numbers and of good quality, in that locality. From the date last named to 1839, importations were quite frequent, when a period of years occurred in which few, if any, short-horns were imported.

In 1849, Mr. Thomas Bates, a distinguished Short-horn breeder in England, died, and his herd fell mostly into the hands of Lord Ducie, who already owned a noble herd, to which he now added the Bates stock. He was a skillful breeder, and during the brief time he held them he increased, if possible, the reputation of the Bates stock. Only three years after purchasing these cattle Lord Ducie died, and a peremptory sale of his stock was advertised. The attendance of English breeders was large at this sale, and several American gentlemen went over to witness it, and some of the finest and highest priced animals were bought by Mr. Samuel Thorne, of Dutchess County, N. Y. L. G. Morris and Noel J. Becar also bought animals at this sale, and added others from other choice herds. Soon after, importations which included some of the "Bates" blood were made by Ezra Cornell, of Ithaca, and James O. Sheldon, of Geneva, N. Y.

Between 1852 and 1856 several companies were formed in Clinton, Madison, and other counties of Ohio, and in Bourbon,

Fayette, and other counties of Kentucky, and importations made from the best English herds, so that by the latter date, the United States undoubtedly possessed—though in less numbers—as valuable a selection of Short-horns as could be found in England itself. The English Herd Book was begun in 1822, and at this date contains in its sixteen volumes a record of over twenty-three thousand bulls, and thirty thousand cows. The American Herd Book consists of eight volumes, and has recorded over seven thousand bulls and twelve thousand cows.

Characteristics of the Short-horns.—While there are some families noted for their milking qualities, especially among the earlier importations, it is chiefly as beef cattle that they excel. They are of rapid growth and early maturity, with great aptitude to fatten, which gives great rotundity of carcass and early ripeness. A general description of the breed which I find in “Allen’s American Cattle Book,” is as follows: “Head—the muzzle fine; the face slightly dishing or concave; the cheeks lean of flesh; the eye full and bright; the forehead full and broad; the horns showing no black except at the tips, and standing wide, short and oval shaped, at the base spreading gracefully out, and then curving in with a downward inclination, or upward with a still further spread—as either form is taken without prejudice to purity of blood in the animal—of a waxy or neutral color, and sometimes darker at the tips; the throat clean, without dewlap; the ear sizable, thin, and quickly moving; the neck full, setting well into the shoulders and breast, with a slight pendulous hanging of the skin—not a dewlap—just at the brisket; the shoulders full and nearly straight, full and wide at the tops; the shoulder points, or neck-vein, wide and full; the brisket broad, low, and projecting well forward, sometimes so much as to almost appear a deformity; the arm gracefully tapering to the knee, and below that a leg of fine bone ending with a well-rounded foot; the ribs round and full—giving free play to vigorous lungs—and running back well towards the hips; the crops full; the chine and back straight from the shoulders to the tail; the hips wide, and level with the back and loin; the loins full and level; the rump long and wide;

the tail set on a level with the back, small and tapering; the thigh full and heavily fleshed; the twist wide; the flank low and full; the hock or gambrel-joint standing straight—as with the horse—or nearly so; the hind-leg like the fore one, clean and sinewy, and the foot small.”

From this description it will be seen that a marked characteristic of the “Short-horn” is rotundity of carcass, and a small percentage of waste, the bone and offal being but a small per cent of the entire weight of the animal.

In color they range from pure white to deep red, and between these colors all the variations of roan, red and white, flecked, and spotted. For many years past, the fashionable color in the United States has been red, and this preference has, we think, been carried to a foolish extreme, which has led breeders to castrate animals that possessed every valuable point except the one of color. It is believed, however, that this fictitious value of mere color will not have as much influence in the future as in the past, as some breeders are using roan bulls for the very purpose of breaking down the prejudice. In England there has not been this prejudice against white, and in favor of red color. The heifer already referred to as exhibited by Mr. Colling, was a pure white; and as late as 1883, the first prize at a prominent English cattle show was awarded to a white animal, while in the United States the color would have ruled it out.

Short-horns must have abundant feed and good pasturage, and therefore are best adapted to rich, level, or gently undulating lands. On rolling broken land that produces short grasses or scanty herbage, some of the smaller, more active breeds of cattle will give better results.

The great points of value in the Short-horn, are early maturity—whereby it is claimed that an entire year of care and keeping can be saved over most other breeds—weight of meat, ripeness of points, and giving the most flesh in the best places, so that the butcher can get more high-priced cuts from the carcass than from an ordinary bullock. It is also a fact of great importance to the farmer, that the Short-horn bull, when used on

native cows, imparts these valuable qualities to his offspring in large measure, often making grades nearly as valuable as thorough-breds for the butcher. No other breed of cattle has contributed so many valuable points to the stock of the United States, and it is doubtful if any other will ever supplant it as a general purpose animal.

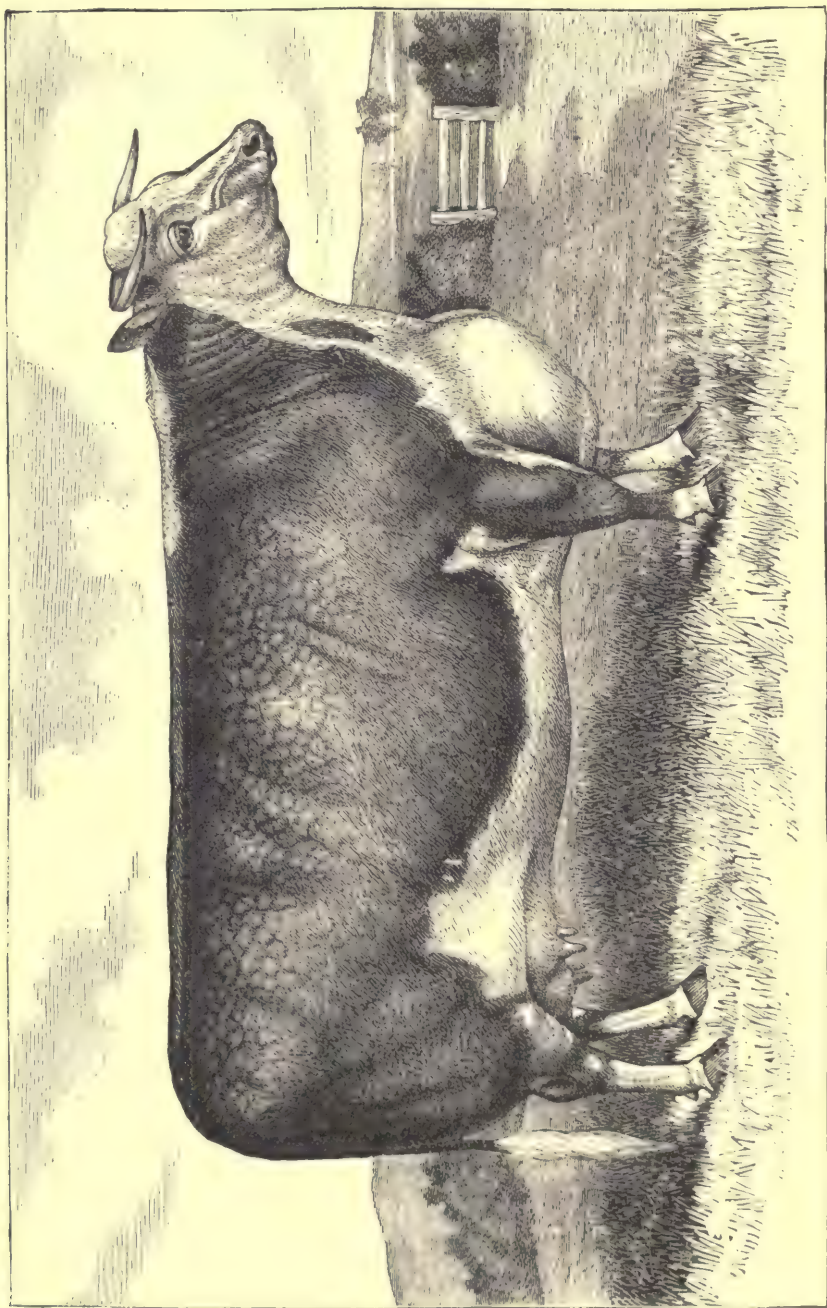
The Herefords.—It is but recently that this breed of cattle have assumed prominence in the United States, but they are now, among many of the beef-producing farmers of the West, held in high esteem, and bid fair to rival the Short-horns.

The Hereford is an English breed, taking its name from Hereford County, although they have been long bred in several other counties of England, and also in Wales. This breed is always spoken of as of ancient descent. The Herefords of a hundred years ago were deep red—almost brown—in color, with mottled faces; now they are usually red with shades running into light or yellowish red, with white faces, throats, bellies, and sometimes backs. Occasionally a roan will be found, and more rarely an almost pure white with red ears.

Allen, in his “American Cattle Book,” says: “Perhaps we can not convey a better description of the Herefords than to say: give a Devon a quarter more size, somewhat more proportionate bone and horn, a trifle shorter legs and longer body, a little coarser in every respect, and you have a good Hereford in all except color.”

The Herefords do not excel as a dairy breed, and the instances are rare in which superiority as milkers is claimed for them. Their milk is rich in quality, but deficient in quantity; breeding in later years has been with a view to increase the tendency to take on flesh rather than to develop the milking qualities. In the days when oxen were largely used and sought after there were no cattle considered superior to the Herefords for this purpose. They are large, strong, and muscular, well developed and powerful, and while not quite so active as the Devon, are much stronger.

As a beef animal the Hereford is superior. They mature early, are thrifty in growth, feed well, and show well on the



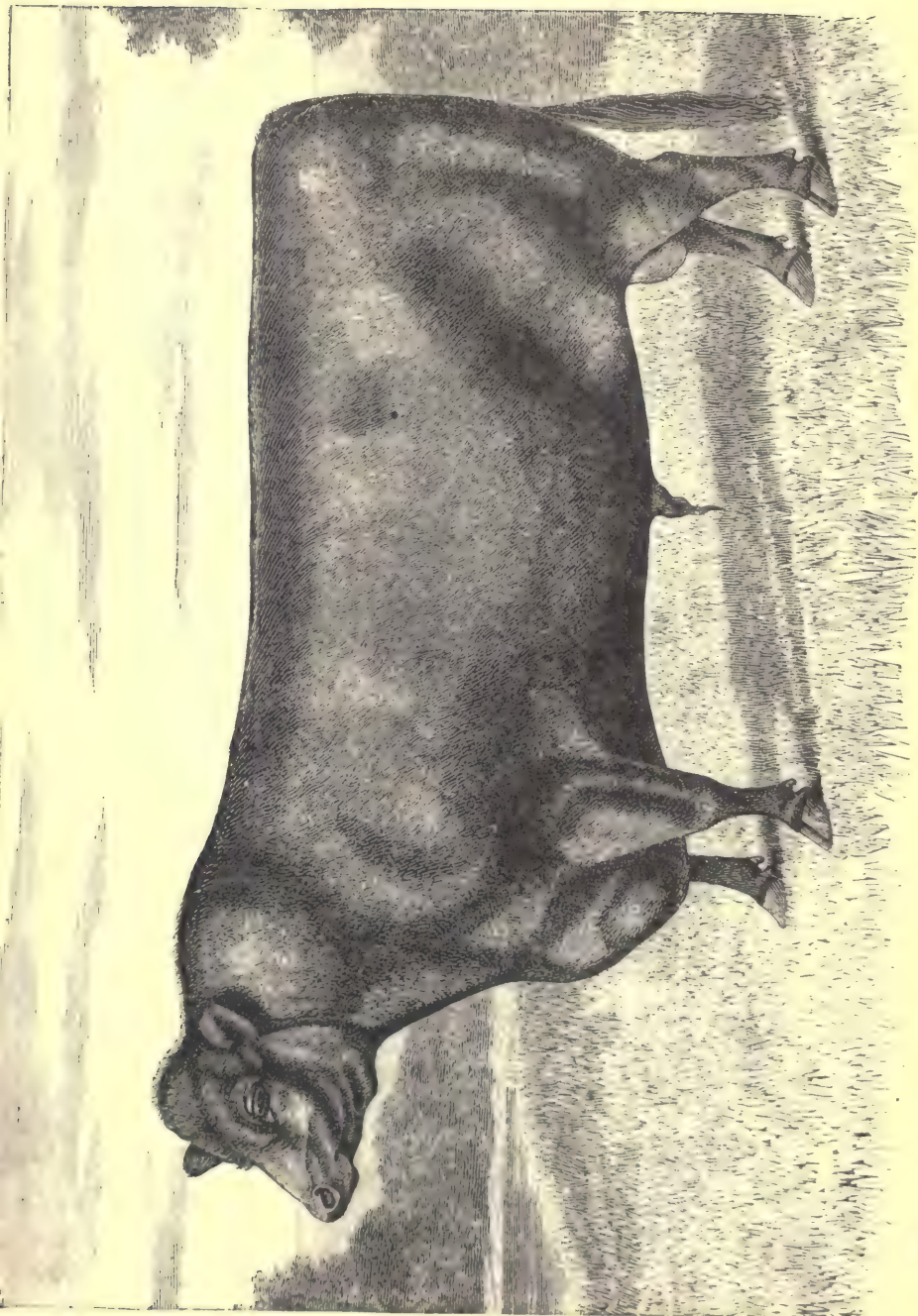
HEREFORD COW.

From T. L. Miller, President of the Breeders' Live Stock Association, Beecher, Ill.

butcher's block. At the prize shows in the London market, they compete successfully with other improved breeds. It is claimed by some English breeders who oppose the Herefords that the improvement shown in them in modern times is due to a stealthy cross with Short-horns. Whether or not this is true is difficult if not impossible to determine, but in any event the Herefords of to-day are possessed of valuable points and are growing in popularity.

When they were first introduced into the United States is not known, but occasional marks among our native cattle show evidence of Hereford blood, which must have come from some importation of which we have no record. The first of which we have a record was by Henry Clay in 1816 or 1817, but as Mr. Clay soon after became a breeder of Short-horns and discarded the Hereford's, this importation left no permanent impress on the herds of that vicinity. A few years subsequently, a Hereford bull, and possibly a cow or two, was sent from England to Massachusetts by Sir Isaac Coffin, and this bull was crossed extensively on native cows, and left his impress on the cattle of the vicinity where he was used. A large importation was made in 1840 by an Englishman. These cattle were first taken to Jefferson County, New York, and the herd was afterwards scattered, the bulk of it going to near Albany, New York, and a part into Vermont, where they were bred for some years, sold, and scattered. Among those who have been successful breeders of these cattle may be named Mr. Erastus Corning, of New York, Mr. George Clark, of the same State, and Thomas Aston and John Humphries, of Lorain County, Ohio.

In 1860 and 1861, Mr. Frederick Stone made two importations of superior Hereford's into Canada, and about half these cattle and their descendants were sold to breeders in the United States. More recently numerous importations of good Hereford cattle have been made, both into the United States and Canada, and scattered chiefly through the Western States for crossing on the native and Texas cattle, as the cross has proved extremely valuable for beef. They are also now largely bred pure to supply the demand for this purpose, as they are rapidly gaining in



ABERDEEN ANGUS BULL.

public favor. A herd-book has been established to record them, and the breed may be considered as established. While they may not equal the Short-horns in early maturity, they perhaps come nearer that breed as a beef producer than any other, and will undoubtedly maintain a high position among the cattle of the United States.

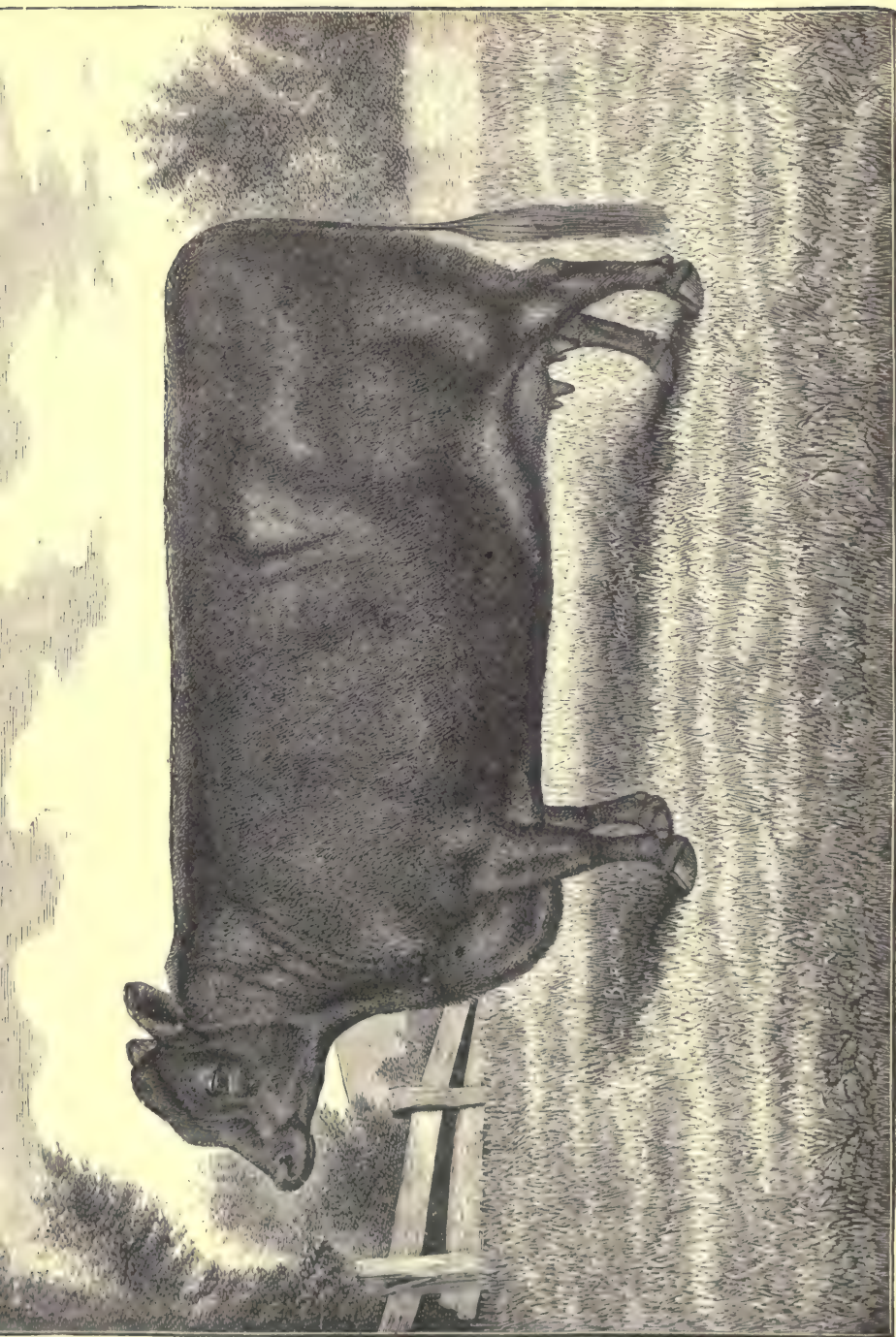
The Aberdeen-Angus, Galloway, or Polled Cattle.—

These cattle are a hornless race originating in Scotland. They have always been favorites with English farmers on account of their large size and excellent fattening qualities, and also because they are of a mild disposition, and the absence of horns makes them much safer to handle and ship than other cattle. These cattle are described as straight and broad in the back, nearly level from the head to the rump, round in the ribs, and broad in the loin.

In roundness of barrel and fullness of ribs they compare favorably with our best breeds. The Galloway is short in the leg and moderately fine in the shank bone; and with the same cleanness of bone and shortness of shank, there is no other breed so large and muscular above the knee. The chest is deep, broad, and capacious. The neck of the bull is thick, almost to a fault, but a thin and delicate neck would not correspond with the broad shoulders, deep chest, and close, compact form of the breed. The head is rather heavy, the eyes not prominent, and the ears large, rough, and full of long hairs on the inside; the skin loose and mellow, of medium thickness; the hair long, soft, and silky. The prevailing and fashionable color is black, but a few are of a dark brindled brown, or a dun or drab, and still fewer are speckled with white.

The bulls have a remarkable prepotency to impress their characteristics on other breeds of cattle. In my own county I have seen them crossed on Short-horns with the result that a very large per cent of the offspring were hornless. It is often the case when crossed with horned cattle, that small horns will be found attached merely to the skin, instead of to the skull.

The Galloway's are not good milkers; for while they give rich milk, they can not be depended on to average more than



six or eight quarts for the first five months after calving, and they will usually go dry for nearly or quite three months. They are very docile and easily managed, and it is rare to find even a bull furious or troublesome.

While there were polled cattle brought to this country as early as the latter half of the eighteenth century, there is no authentic record of any importation until about the year 1850, when some enterprising Scotch farmers imported some of them in the vicinity of Toronto, Canada. There were probably several importations about this time, for as early as 1857 "Allen" speaks of seeing over forty of them exhibited at a single provincial fair. He says of these cattle: "They were full, round, and comely in form, robust in appearance, showing a ready aptitude to take on flesh; elastic to the touch; having a good skin, with long, thick, wavy hair; a placid look, and were apparently of kindly temper. They were mostly black, although there were one or two dull reds or duns, and one brindle."

Since the date above referred to, importations of these cattle have been quite numerous, and during 1883 a single breeder in Missouri imported nine hundred head of bulls and heifers for distribution among the cattle-breeders of the plains. One fact worthy of notice in connection with this importation is that four hundred and sixty-eight of these cattle were brought over at one shipment, and but one bull calf lost. Whether this remarkable success was due to the superior hardiness of these cattle, to the fact that they were hornless and did not injure one another, to superior care on the passage, or to all these combined, it at least shows that cattle *may* be imported with little loss, while often the mortality in bringing them over is fearful.

There is no doubt that polled cattle are becoming more popular every year, and that many of our best breeders are seriously questioning the utility of horns, and believe that while they were necessary for defense for cattle in a wild state, that the time has now come when they should be dispensed with. The polled cattle have already established a permanent reputation in this country, and they are likely to maintain a foothold among the various breeds in our future beef production.

The Holstein.—**FRIESAN OR DUTCH CATTLE.**—The great excellence of this breed of cattle is that they combine, with excellent dairy qualities, large size, and a compact frame, capable of making good beef. They are almost invariably black and white, spotted, pied, or mottled in picturesque inequalities over the body; the horn is short, and the hair short, fine and silky.



HOLSTEIN BULL—NETHERLAND PRINCE.

The property of Smiths and Powell, Syracuse, New York.

While Dutch cattle, presumably of this breed, were brought to this country as early as 1820–25, and other importations were made between 1850 and 1860, it was not till subsequent to the latter date that any herd of pure-bred Holsteins was established, or that the merits of the breed became known. In 1861 Mr. W. W. Chenery, of Boston, Massachusetts, imported a bull and four cows from the best dairy herds of North Holland. The bull, at four years old, weighed 2,465 pounds, and the cows averaged 1,325 pounds. One of these cows gave for ten successive days an average of 74 47-100 pounds of milk, and made, under a six days' test, 17 pounds 14 ounces of butter—nearly three pounds per day. As milk producers they stand high; yearly records of 12,000 to 15,000 pounds of milk are not rare, and 18,000 pounds have been reached.



IMOGENE

HOLSTEIN COW, IMOGENE. Property of S. S. Mann & Co., Elgin, Ill.

During the last twenty years many importations of these cattle have been made and, perhaps, no breed has grown in favor more rapidly than these wherever they have been introduced, and we predict that they will take a prominent place in the future, both for the dairy and as a general purpose animal.

Mr. Powell, of Syracuse, New York, in a recent address before the Farmer's Club of Onondaga County, New York, in



HOLSTEIN COW—AGGIE.

The property of Smiths and Powell, Syracuse, New York.

answer to the question, "Are Holstein's good butter cows?" made the following statement:

"Holsteins have not yet equaled the highest yield made by a few Jerseys, but we think the average is considerable higher, and with a like effort in that direction I think the highest Jersey records will be reached. As Holstein's milk more evenly throughout the year and hold out longer, I am confident, as a class, that their yearly yield of butter will be greater. Of course, the Jerseys will make more butter from a given amount of milk, but the larger flow of the Holsteins will more than make up the difference, and contrary to the general expressed opinion, I consider this an important item in favor of the Holsteins. With the present custom of using coolers in creameries the milk is sweet after the cream is removed.

“The Holstein milk, containing, as it does, a large per cent of casein and other solids, is still worth half the price of new milk for making cheese and feeding young stock, and will pay largely toward the keeping of the cows. Calves can be fattened for the butchers on skimmed Holstein milk. Colonel Hoffman, whose statement will be unquestioned, states that he has produced a growth of one hundred pounds per month on calves fed only on Holstein milk, after the cream had all been taken off. This is no small item in favor of the breed, and will add largely to the credit side of the account. You are all probably aware that the small amount of skimmed milk, left from the light yield of the noted butter breeds, is almost entirely worthless for cheese or feeding young stock. It is, therefore, a great mistake to suppose that the best and most profitable butter cows are those that make the most butter from the smallest amount of milk. The yield of butter being equal, the balance will be in favor of the larger flow, and the better quality of milk after removing the cream.

“On this last point I wish to be fully understood, as my ideas are contrary to the generally accepted theory. We almost daily hear the assertion and see it in the stock journals, that certain cows are remarkable for butter for the simple reason that a pound of butter has been produced from a very small amount of milk. This I claim to be a false basis on which to estimate profits. If two cows, one giving fifty pounds of milk per day, and the other twenty pounds, each produce two pounds of butter per day, other things being equal, the former is decidedly the most profitable and desirable. We will make this point clear by taking for illustration a Jersey cow that will give six thousand pounds of milk in a year, and a Holstein cow that will give twelve thousand pounds. Here allow me to say, that actual records will show the latter to be much more common in proportion to the number of each breed of cows in this country than the former. Each we will suppose to make the same amount of butter. The cream taken from the Jersey milk will probably be about twenty-five per cent, leaving of the skim-milk four thousand five hundred pounds. The cream on the Holstein

milk to correspond with the above estimate would be about fifteen per cent (the Jersey cream being more dense and solid), which will leave ten thousand two hundred pounds after the cream is removed, or five thousand seven hundred pounds more than the Jersey, which is worth half the price of new milk for cheese, to feed young stock, or to sell in the market. This estimate is on the supposition that the Jersey milk, after removing twenty-five per cent cream, is equal to the Holstein after removing only fifteen per cent, which is far from the fact. Any party who has given the subject attention will agree that the skim-milk of the Holstein is worth fully double that of the Jersey. In fact, the Holstein milk, after remaining in the cooler twelve hours from the time of setting, at which time the cream is removed, is perfectly sweet, and will compare for family use, or for food for children, with a fair sample of whole milk, as it is frequently sold in the market. From this you can make your own estimates, and you will see that the product of the Holstein cow above that of the Jersey will nearly or quite pay her keep for the year."

The sixth volume of the *Holstein Herd Book* shows in this country, at the close of 1882, one thousand seven hundred males, and three thousand two hundred and eighty-eight females.

Devons.—This beautiful breed of cattle dates back further than any other among us. While they generally go under the name of "Devon" simply, the true name is "North Devon," as the cattle from the south part of Devonshire were of a larger and coarser frame, with less tendency to fatten, although of superior quality for the dairy. They have been bred for many centuries in England, and great attention has been paid to their improvement during the last century. In fineness of limb, uniformity of color, delicacy of proportion, and purity of breeding they are unsurpassed by any other race of cattle.

In localities where oxen are largely used, the Devons are highly esteemed for this purpose, as they rank among cattle as the "thorough-bred" among horses. According to their size they combine more fineness of bone, more muscular power, intelligence, activity, and bottom, than any other breed.



DEVON BULL.—IMPT. CLANNABORO, 1967.
Property of George Baker & Son, Hustisford, Dodge County, Wisconsin.

One thing remarkable about the Devons is the comparative smallness of the cow. A well-grown steer will weigh from one thousand four hundred to one thousand six hundred pounds; the bull from one thousand to twelve hundred, and the cow from eight hundred to one thousand. These are given as average weights, and are often exceeded by careful handling and high feeding. At a Vermont county fair in the autumn of 1883, fifty-three yokes of cattle of this breed were exhibited. Of these cattle there were seventy-five that weighed fifteen hundred pounds or more, each; the heaviest pair weighing three thousand seven hundred and eighty pounds, and the next heaviest three thousand seven hundred and thirty. Considering that the Devons are a fine breed and have been classed as small cattle, these weights are remarkable.

The Devons are probably found in greater excellence and abundance in New England than anywhere else in the United States. Their size has been increased considerably in the hands of careful breeders in England during the last century.

As a dairy cow, the Devon occupies a medium rank, as to quantity of milk, but the quality is superior, and perhaps no other breed except the Jersey will yield as much butter from a given quantity of milk. If careful selections are made, and these cattle bred with a view to developing their dairy qualities, few breeds will equal them for this purpose. The cow is docile in temper, easy to keep, and readily managed. Her udder is soft, of good size and shape, with thin, silky hair, taper teats, easily milked, and every way satisfactory to her owner.

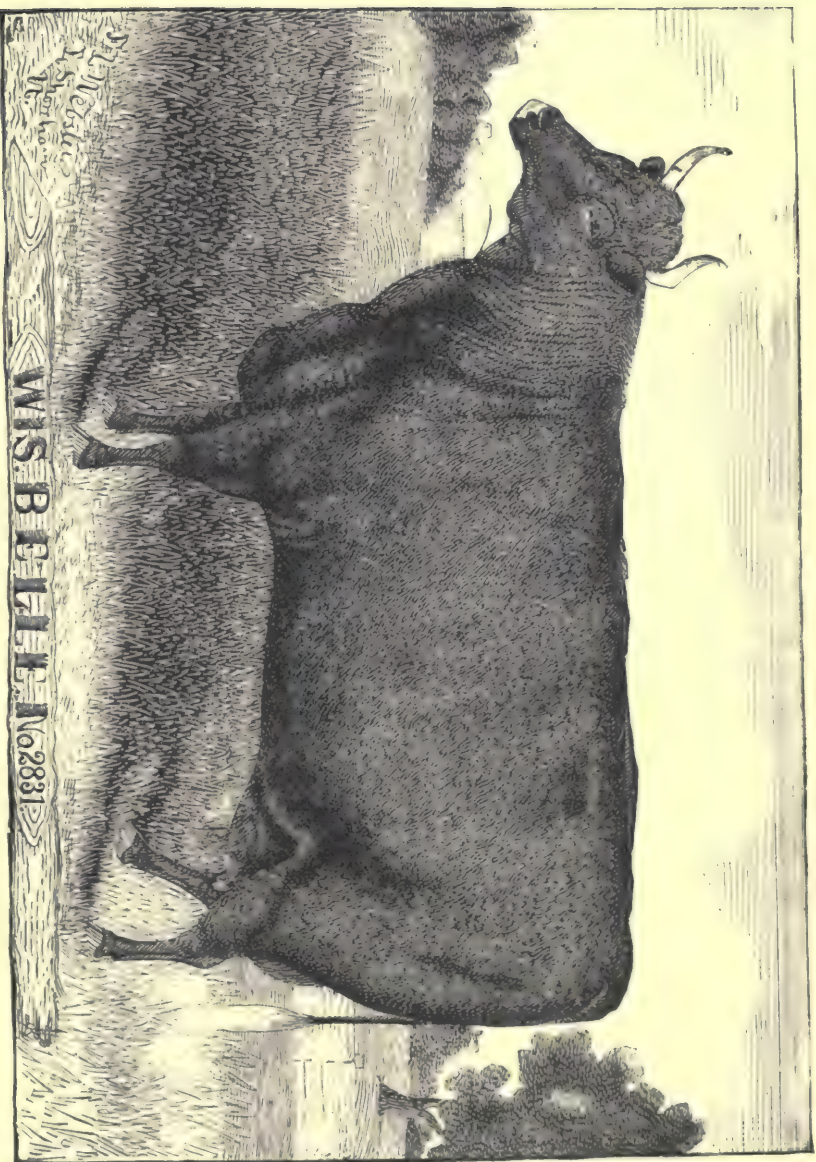
"Allen," in his book on "American Cattle," says: "We have kept thorough-bred Devons for thirty-four years, sometimes as high as twenty-five or thirty in number. Many of them have been excellent milkers; some of them extraordinary for their size. We had once, two three-year-old heifers which gave, for some three months after calving, on pasture only, an average of eighteen quarts each per day." All things considered, the Devons may be classed as good dairy cows, and, taking into account their size, consumption of food, disposition, appearance, and quantity and quality of milk, they will give good satisfaction.

As a beef animal, the Devon ranks as first-class for fineness of flesh and delicacy of flavor. It matures as early as the Short-horn, and its meat is finer grained, juicy, and nicely marbled. In the London markets Devon beef usually brings a penny a pound more than that of the larger breeds. They are good feeders, taking on flesh rapidly, and their flesh is of excellent quality. They have been fed in England to attain a net weight of from nine hundred to over fifteen hundred pounds, and a pair of Devon oxen, in Connecticut, which were worked till six years old, and then fed for fifteen months, made the following weights:

No. 1—Carcass,	1,438 lbs.
Hide,	117 “
Tallow,	175 “
Total,	1,730 “
No. 2—Carcass,	1,528 lbs.
Hide,	115 “
Tallow,	213 “
Total,	1,856 “

These weights are exceptional, however, but Mr. Allen says that he has slaughtered many steers at three and a half years old which gave a profitable weight—quarters, hide, and tallow—of from seven hundred to eight hundred and fifty pounds, which never had been fed any thing but grass and hay. Still, popular opinion in the United States classes them as too small for the most profitable beef animal, and on our rich prairie lands they can not compete with the Short-horns, Herefords, and Aberdeens. In the Southern States they are popular, and often preferred to any other breed, as they bear the climate well and are more free from diseases than many others. Their muscular activity makes them valuable for high, rolling lands and mountain ranges, and on such farms they will give better satisfaction than the heavier breeds.

Devons in the United States.—The accounts of the earlier introduction of these cattle to this country are meager. From the appearance of the New England cattle, there is little doubt that some Devons were early brought into Massachusetts,



DEVON COW—WISCONSIN BELLE, 2831.

Bred and owned by GEORGE BAKER & SON, Hustisford, Dodge County, Wisconsin.

but there is no record of any importation of them till 1817, and these were brought to Maryland, by Messrs. Caton and Patterson. The year following—1818—Mr. Rufus King, of Jamaica, Long Island, imported a few; and still another lot were brought to Maryland by Mr. Henry Thompson, not long after.

About the year 1836 an English farmer, named Vernon, brought a bull and cow of this breed into Genesee County, New York, from the herd of Mr. Davy, in England, and between 1840 and 1850 the Massachusetts Agricultural Society made a considerable importation of Devons, which were distributed in various parts of New England. Several importations have been made since 1850, and all of them of the choicest selections, equal, probably, in style and quality, to any in England. These herds have been carefully bred, and their produce widely disseminated, and have done much to improve the lighter cattle of our country.

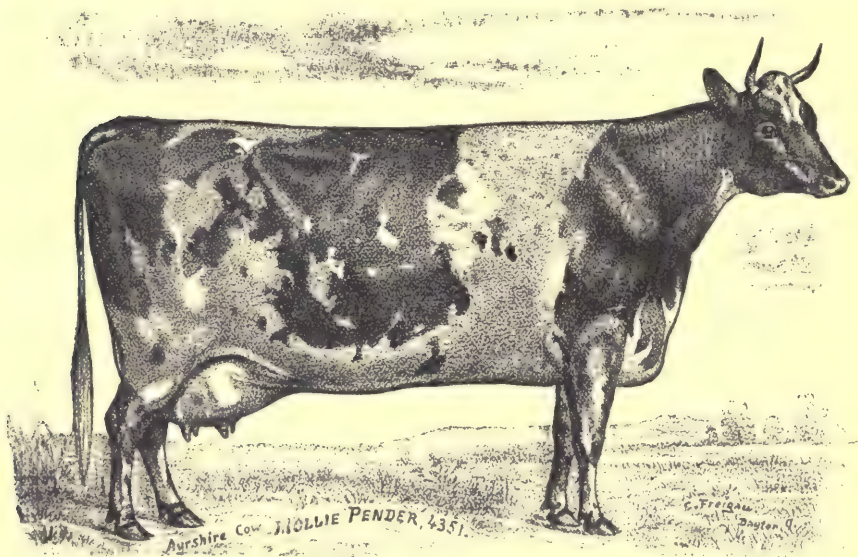
The following description of the Devons I find in "Allen's" book on "American Cattle:" "The head—lean in flesh, is rather short; the forehead broad, the face slightly dishing, and tapering gracefully to a fine, clear, yellow muzzle. The eye—bright, prominent, and surrounded by a ring of orange-colored, or yellow, skin. The horn—upright, and curving outward, cream-colored, and black at the tips, graceful in its setting, and rather long for the size of the animal. The ear—well-set, and lively in action. The neck—on a level (in the bull slightly arching) with the head and shoulders, full at its junction with the breast, clean, and without dew-lap. The shoulders—fine, open (somewhat slanting like those of the horse), and on a level with the back. The neck-vein—full and smooth. The arm—delicate, and the leg, below the knee, small, terminating in a clean, dull-brown, and some striped hoof. The brisket—full, and projecting well forward. The crops—well filled, and even with the shoulders. The back—straight from the shoulders to the tail. The ribs—springing out roundly from the back, and running low down, to inclose a full chest, and setting well back towards the hips, giving a snug, neat belly. The flanks—full, and low. The hips—wide, and level with the back. The loin—

full, and level. The thigh—well-fleshed, and full, the lower part somewhat thin, and gracefully tapering to the hock, the leg below small, flat, and sinewy. The twist (the space between the thighs)—well let down, and open. The tail—taper, like a drum-stick, and terminating with a bush of white hair. The color—invariably a cherry-red, sometimes showing a lighter or deeper shade, and the skin under the hair a rich cream color. The bull will show the stronger and masculine character of his sex; the steer will develop the finer points, and the cow, all the delicacy and refinement belonging to her race. In the roundness and fullness which accompany the proper development of the points named, the silky, wavy laying of the hair, and the elastic touch of the flesh, as the finger is pressed upon it, every beholder will at once see a most blood-like and graceful animal.”

The Ayrshires.—The origin of this breed of cattle is even at the present day a matter of dispute. It is certain that as late as the middle of the eighteenth century there was no such breed in Cunningham or Ayrshire—the localities more recently famous for them—or even in Scotland. As late as 1783 Mr. Aiton described the cattle of Ayrshire as follows: “The cows kept in the districts of Kyle and Cunningham were of a diminutive size, ill fed, ill shaped, and yielded but a scanty return in milk. They were mostly black, with large stripes of white along the chine or ridge of the back, about their flanks, and on their faces. Their horns were high and crooked, having deep ringlets at the roots; a sure sign that the cattle were but scantily fed. The chine of their backs stood up high and narrow; their sides were lank, short and thin; their hides thick, adhering to their bones; their hair was coarse and open, and few of them yielded more than six or eight quarts of milk a day when in their best plight, or weighed when fat more than three hundred to four hundred pounds, net.”

The modern Ayrshire which was obtained from this same locality bears no resemblance to the cattle above described. The cattle of Ayrshire are no longer the meager, unshapely, unprofitable animals described by Aiton, but almost double the

size, and yield much more than double the quantity of milk. The pure Ayrshires are generally red and white, spotted or mottled, not roan, like many of the Short-horns, but often presenting a bright contrast of colors. They are sometimes, though rarely, nearly or quite all red, and sometimes black and white, but the favorite color is red and white brightly contrasted, and by some breeders strawberry-red is preferred. The head is small, fine, and clean; the face long, and narrow at the muzzle, with a sprightly yet generally mild expression; eye small,



AYRSHIRE COW—MOLLIE PENDER, 4351.

From Robert W. Carrons, Washington, Pennsylvania.

smart and lively; the horns short, fine, and slightly twisted upwards, set wide apart at the roots; the neck thin, body enlarging from fore to hind quarters; the back straight and narrow, but broad across the loin; joints rather loose and open; ribs rather flat; hind-quarters rather thin; bone, fine; tail, long, fine and bushy at the end; hair generally thin and soft; udder light colored and capacious, extending well forward under the belly; teats of medium size, generally set regularly and wide apart; milk veins prominent and well developed. The carcass of the pure Ayrshire is light, particularly the fore-quarters, which is

considered an index of great milking qualities, but the pelvis is capacious and wide over the hips.

While the Ayrshire lacks something of the symmetry and aptitude to fatten found in the Short-horn, it is, on the whole, a good-looking animal. While there is some doubt about the matter, I find the best authorities agree in the probability that the Ayrshire cow was produced by a cross of Short-horn blood on the small native cattle before described, or at least that they contributed to its production.

All authorities agree in giving to the breed a high rank as dairy cows. Mr. Aiton says: "Hundreds and thousands of the best Scotch dairy cows, when they are in their best condition and well fed, yield at the rate of one thousand gallons of milk in one year; that in general from three and three-quarters to four gallons of their milk will make a pound of butter." This statement applies to choice cows, but Mr. Rankine reports that two dairymen of his acquaintance, one of whom kept from twenty to thirty, and the other from thirty to forty cows, reported to him an average yield per cow of six hundred and fifty gallons in the first case and six hundred and eighty-seven and one-half in the second. One of these dairymen reported that a fraction more than two and one-half gallons of milk made a pound of butter, and thirty-two gallons of new milk made thirty-six pounds of cheese or forty-eight gallons of skimmed milk produced the same quantity.

In further confirmation of the value of the Ayrshire as a dairy cow, I quote from Allen's "American Cattle:" "The quantity of milk yielded by the Ayrshire cow is, considering her size, very great. Five gallons daily for two or three months after calving may be considered as not more than an average quantity. Three gallons daily will be given for the next three months, and one gallon and a half during the succeeding four months. This would amount to more than eight hundred and fifty gallons; but allowing for some unproductive cows, six hundred gallons per year, is the average quantity obtained annually from each cow. Three gallons and a half of this milk will yield about a pound and a half, avoirdupois, of butter,

or an average of about five pounds of butter per week the year round."

"Flint" says of the Ayrshires in his work on "Dairy Farming:" "We must conclude that for purely dairy purposes the Ayrshire cow deserves the first place. In consequence of her small, symmetrical, and compact body, combined with a well-formed chest and a capacious stomach, there is little waste, comparatively speaking, through the respiratory system, while at the same time there is a very complete assimilation of the food, and thus she converts a large proportion of her food into milk. So remarkable is this fact that all dairy farmers who have any experience on the point agree in stating *that an Ayrshire cow generally gives a larger return of milk for the food consumed than a cow of any other breed.*"

It is claimed by good authority that the milking qualities of the breed have been developed by the selection of bulls of a feminine appearance. While the Ayrshire is pre-eminently a dairy breed, it is conceded that they fatten kindly and profitably; but "Youatt" says of them: "It will be long, perhaps, before they will be favorites with the butchers, for the fifth quarter (hide and tallow) will not weigh well in them." Their fat is mingled with the flesh rather than separated in the form of tallow, but this gives a more beautiful appearance to the meat, and should enhance its price.

"Flint" recommends that they be crossed with the Short-horn, using bulls of the latter breed of superior milking strains, and that this will give improved size and form with little danger of reducing the valuable dairy qualities.

The Ayrshires in the United States.—I can find no record giving dates of their importation, or the names of importers, but they have been on trial here for about a half-century, and have been successful. It is a fact, however, that they do not yield so large a quantity of milk in this country as in Scotland. The chief reason for this is found in the difference of climate. Ayrshire has a moist climate—an almost continuous drizzle of rains or moisture pervading it—making fresh green pastures; a cooler and more equable temperature in summer,

and warmer in winter than ours. Our climate is more liable to extremes of heat and cold, and protracted droughts, and this difference accounts for the difference in yield. Cows of this breed imported to this country, and accompanied by certificates of their yield in Ayrshire, have here given about two-thirds as much, but, even with this falling off, are accounted good milkers.

The Jerseys—Alderney—Guernsey—or Channel Island Cattle.—Practically these are all one breed of cattle, but have been variously named as they were brought from one or another of the Channel Islands. These cattle were introduced into the United States as early as 1820, and about 1850, large importations were made. During the decade from 1870 to 1880, great interest was awakened in the breed, and large and frequent importations made. There is a strong and bitter opposition to these cattle on the part of many farmers on account of their small size, but they are exceedingly popular with villagers who keep but one cow, as they are delicate and fawn-like in appearance, and produce large quantities of rich, yellow cream and butter, in proportion to the amount of milk they give.

There are on record many remarkable yields of butter from individuals of this race, sixteen to eighteen pounds, and even more having been made in a week. This was under high feeding and extra care, and must not be taken as an average, or even a result easily attained; but still there is no disputing the fact of the superior richness and high color of Jersey milk. Another fact has added to their popularity, and that is, that the grades descended from native dams and Jersey sires partake largely of the superior butter-producing quality of the breed, and often, with improved size, are found nearly, or quite as valuable for the dairy as the thorough-bred. A half-blood Jersey raised in my neighborhood, made fifty-one and one-half pounds of butter in May, after dropping her second calf.

The Jersey is simply a milking cow, and should be bred for this purpose and no other, and yet Youatt says of them: "One excellence it must be acknowledged, that the Alderneys possess; when they are dried, they fatten with a rapidity that would be scarcely thought possible from their gaunt appearance.



One thing that undoubtedly has had great influence in reducing the size of the Jerseys is, that they breed very young, it being quite common for the heifers to drop their first calf at fifteen months old, and if allowed access to the bull, they will usually come in at from seventeen to twenty months old. While it is admitted that the size has been reduced by this trait, it is nevertheless a valuable one, for the Jerseys will never be grown as a beef animal, and if they can be made to pay their way from the time they are fifteen or eighteen months old, it is certainly better than to keep them a year longer unproductive for the sake of adding one or two hundred pounds to their weight. I am now milking a three-fourths Jersey who dropped her second calf when thirty-one months old, after having been milked a year, and I estimate that her milk and butter alone paid all the expense of raising her up to the time she dropped her first calf at seventeen months old.

We describe the Jersey as follows: The head—muzzle fine, the nose either dark-brown or black, and occasionally a yellowish shade, with a peculiar mealy appearance, light colored hair running up the face into a smoky hue, where it gradually takes the general color of the body; the face is slightly dishing, clean of flesh, mild and gentle in expression; the eye clear and full, and encircled with a distinct ring, the color of the nose; the forehead bold; the horn short, curving inward, and waxy in color, with black tips; the ear, sizable, thin, and quick in movement. The whole head is original and bold-like in appearance, more so than in almost any other race of cattle, reminding one strongly of the head of the American elk. The neck is somewhat depressed—would be called ewe-necked by some—but clean in the throat, with moderate or little dewlap; the shoulders are thin and somewhat ragged, with prominent points running down to a delicate arm, and slender legs; the fore-quarters stand rather close together, with a thinish, but well-developed brisket between; the ribs are flat, yet giving sufficient play for good lungs; the back depressed from a straight-line; the belly deep and large; the hips tolerably wide; the rump and tail high; the loin and quarter medium in length; the thigh

thin and deep; the twist wide, to accommodate a clean, good-sized udder; the flanks medium; the hocks or gambrel-joints crooked; the hind-legs small; the udder capacious, square, set well forward, and covered with soft silky hair; the teats fine, standing well apart, and nicely tapering; the milk veins prominent.

On the whole, she is a homely, blood-like, gentle, useful little cow, with a kindly temper, loving to be petted, and readily becomes a great favorite with those who have the care of her.



JERSEY BULL—COBURN'S PRIZE, 6,851.

The property of Beech Grove Farm, Beech Grove, Marion County, Ind.

The color is usually light, red, or fawn, occasionally smoky-gray or squirrel, and sometimes black mixed, or plashed more or less with white. Roan colors, and a more rounded form, are occasionally found, but are not fancied by breeders. The Guernsey is usually one-third larger, of similar shape, but with more of rotundity and symmetry of form, and a superior tendency to flesh, while in dairy qualities they are not inferior.

While the Jersey cow is noted for her gentleness, the bulls are much inclined to be vicious if kept till maturity.

The Spanish or Texan Cattle.—We describe these cattle not on account of their merit or desirable qualities, but

because they have filled an important place in the cattle-raising of the plains, and even been brought in large numbers to our Eastern markets. These cattle probably originated from stock imported into Mexico from Spain, as early as 1525. A modern traveler describes the cattle of Spain as follows: "They are of small size, with large, coarse, long, and wide-spreading horns, mostly with a half or full twist to them, and set back rather than forward, with the point outward. Their colors are black, dark-brown, reddish-brown, light yellowish-red, with some white on throat and belly, and occasionally a black and white roan, or gray. The cows are nearly as large as the oxen, with the same style of horn. The head is long and rather fine. They do not appear to be good milkers."

This description is so nearly that of the Texan cattle as to clearly show them to be of the same stock, and the similarity is the more striking, when we remember that the Spanish cattle are thoroughly domesticated and treated with care in a country of dense population and close husbandry, while the Texas cattle are descendants of stock which had run wild for many generations.

These cattle, as found on the plains of the West, are tall, lank, and bony, with coarse heads and enormous horns, legs long and coarse; they have much dewlap, and little brisket, flat sides, somewhat sway-backed, high in the flank, with narrow hips and quarters, and with a large proportion of offal. They mature slowly, and are usually not marketed till from five to seven years old. The cows are poor milkers, and only continue in milk long enough to rear a calf. While these cattle were well-suited in many of their characteristics to the system of management of a former generation, they are destined to extinction under a better system of farming, and will be superseded by larger and finer cattle that mature much earlier. This improvement is now going on rapidly by crossing with the improved breeds, and in a few generations the wild, long-horned Texan will be modified, until in form, color, and valuable qualities, it will resemble the Short-horn, Hereford, or polled Angus.

CHAPTER IX.

CATTLE—GENERAL MANAGEMENT.

IN quite an extensive experience in buying cattle, I have had a chance to observe the management on a large number of farms, and my conclusion is that in many cases the owners realize no profit from them, barely getting paid for what they feed them, or (as is the case in some instances) actually losing money. I also came to the conclusion that in most cases this was due to the parsimony, carelessness, or want of management of the owner, and that attention to a few points easily within control of the owner would prevent loss.

Mistakes of Stockmen.—The first wrong step is in selecting the sire, the farmer getting the service of the bull that will cost the least. In many neighborhoods I have known the services of a thoroughbred Short-horn offered for the sum of two dollars, and not patronage enough obtained to pay the expense of keeping. It is quite a common practice to allow a bull calf to run till a year or fifteen months old and sire a few calves and then castrate him, and it is not uncommon to find several yearling bulls on a farm. A calf that has run to this age without castration will always be classed as a stag, and will not bring as much when fat by one or two cents a pound as a good smooth steer. It requires no special skill to castrate a calf a week old, and any farmer can do it and the calf scarcely feels it at all, but the longer it is postponed, the more difficult, and severe, and dangerous the operation becomes. Until acquainted with the facts, it is difficult to believe how large a per cent of the male calves are injured by allowing them to run too long without castration.

The next point I notice in unprofitable cattle raising is

stunting the calves. This is often done during the first few weeks, or the first winter, and not infrequently the calves are first stunted on skimmed milk, and this is followed by wintering on poor hay or at the straw-stack, with insufficient shelter, so that when a year old this double process has reduced them to a point from which they can never fully recover. A calf which, from insufficient or improper food, comes to a stand in growth during the first year can never make so good an animal as if kept growing continually. So there is not only a loss of food during this period, but on all the food consumed by it after. To get an idea how common this evil is, it is only necessary to travel, and inspect the stock in March.

In the same line is to be enumerated bad wintering. The animal on grass through the summer recovers in a measure from the starvation of its first winter, and fall finds it fairly thrifty, and if it was now fed so as to keep it growing through the second winter, it would be ready the coming spring to make early and rapid growth, but the farmer has more stock than he has feed for, or neglects to save his feed and depends on the stalk pasture and straw-stack to carry them through, and April finds his stock a hundred pounds lighter than they were in October, and it takes the best part of the grazing season to bring them to the weight and condition they were in the previous autumn, and thus the season of profitable pasturing is shortened to a few months during the hottest season of the year, when flies are troublesome, and short pastures and drought most likely.

This bad wintering often leads to bad summering, for the stock is in so great need of grass that they are turned out as soon as it is possible to get a living, and, as a consequence, the pastures are tramped and gnawed so as to never recover, and the stock is on short rations all summer. This is especially likely to be the case when clover is depended on, as it is more injured by tramping and early feeding than the grasses, and a clover field will not produce half the feed in a season when pastured short early that it will if allowed to bloom before the stock is turned on it. One other common cause of loss is keep-

ing old cows past their prime till they can only be sold to the bologna-sausage makers for about two cents a pound. They form quite a per cent of the stock offered for sale in our cities, and are regularly quoted in the daily markets. These same cows, a few years before, with proper management would have made good beef, and could have been sold at a profit, but were kept at a loss and finally sold at half price.

Raising Calves.—If we expect an animal that will be thrifty and well-developed, and that we can expect with certainty to give good returns for food and care, the first year is the most important, for upon the care it gets at this period depends the future profit. I have seen many intelligent farmers whose judgment on most subjects I should value highly, who had been brought up with the idea that to starve and freeze a young animal made it tough and hardy, and no experience or argument could get this out of their heads. There are two extremes to be avoided in feeding calves; one is feeding too little or too poor food, and the other too much or too rich.

There is no way in which a more perfectly developed animal can be had than by allowing the calf to suck the mother and have access to good pasture, but as a general rule this is considered too expensive, and the majority of calves are raised by hand. I have also found that calves allowed to run with the cow give great trouble by sucking the cows after you wish to wean them, and a calf that has run with its dam through the summer can not be wintered in the same yard with its mother.

That a thrifty, well-developed calf can be raised on skimmed milk, I have proved over and over in my own experience on the farm, and if all the milk could be had for the purpose, and I could get the calves, I could raise well five calves in a season from two good cows; and while they would not be as smooth and well-developed at weaning time as those which had sucked the cow, I should expect them to be as valuable at a year old. There would, of course, be care and labor connected with this plan, but we get all the butter, and can raise five calves instead of two, it will be seen that the labor is well paid for.

Perhaps the question arises, where can we get the calves?

I know it is difficult in many neighborhoods, as the farmers are wise in not selling their calves, but there are few neighborhoods in which there is not a huckster route, and if not near a city market, where you can buy them, an arrangement can usually be made with a huckster to furnish what you want.

To raise five calves from two cows I should want the cows to come in fresh in early spring, so as to be at their greatest flow of milk when the pasture was best, and I should want to buy one calf as near as possible the same age. I always feed new milk for about ten days or until the calf gets to eating well and shows some growth. I then begin to use linseed meal, beginning with a table-spoonful for each calf. Pour hot water over it, and let it stand till it softens and forms a kind of jelly, and then pour it into the skimmed milk, and make it as near the temperature of new milk as you can. I would not change at once from new to skimmed milk, but begin by mixing, and be a week in making the change. The quantity of linseed meal may be gradually increased up to a gill for each calf. I have never experienced any bad effect from this feed, and think that if given in regular quantities it makes up to a large extent for the loss of the cream. I always recommend linseed meal for calves. I wish to caution our readers against the use of cotton-seed meal for this purpose, as I have known of the death of many calves from its use.

I want the calves to run on good grass by the time they are three weeks old, and they will soon begin to graze. By the time they are a month old begin to give some extra feed. Shelled corn is good while they are on milk, but should be fed in moderate quantities, and when weaned bran or a mixture of bran and oats should be substituted. By the time calves are ten weeks old they should be eating enough grass and bran or other food so that the quantity of milk could be reduced and another calf bought, and a month later still another. With good grass and a little other food, after four months old the calves can be made to thrive as well without milk. The calves should have a little grain or bran every day till they go on grass at a year old, as hay or corn fodder is not a perfect

ration, but with the addition of a little food that is rich in flesh formers, and a warm stable, you can keep them growing all winter.

As the flow of milk is greatest during the season of early pasture, it would be less trouble, and perhaps better, to get two extra calves of the same age as the two your own cows had dropped, and raise them all together, for with good cows this could be done. Ordinarily, however, where milk is needed in the family, one calf for each cow is all that can be profitably kept, and I would not under any circumstances keep more than I could feed well, and should not expect to keep a calf thrifty with less than six quarts of milk a day, and then only by the judicious use of linseed meal.

To succeed in growing as good a calf on skimmed milk as on new requires care and skill, and the work can not be trusted to children or left to be done by any one who happens to think of it, but one person should have the care of them, and the feeding should be regular as to time and amount. I prefer feeding twice a day rather than three times, as the calf will begin to graze sooner if allowed to become hungry.

Fall Calves.—For many years after I began farming I sold all fall calves to the butchers, thinking that a calf born at that season could not be profitably raised. After an experience extending over several years, in which I have raised both spring and fall calves, I prefer the latter, and I find that many of the best stock men of my vicinity agree with me. We have more leisure in winter than in summer to attend to a calf, there are no flies to trouble, and the milk will keep sweet, the calf soon learns to eat bran, shelled corn, and hay or corn fodder, and grows thriftily all winter, and goes on pasture at six or seven months' old instead of one year. Your spring calf is weaned on failing pastures, and must have extra care for a full year, but the fall calf having a long season on grass comes to its second winter much better developed, and can be kept thrifty with less care. In a test which I have made with grade Short-horn steers, I found a difference of one hundred and fifty pounds at a year old in favor of the fall calf. These figures

might probably be changed by repeated experiments, but I think that we would usually find about this extra weight at one year old on the fall calf.

The best winter food for calves is a mixture of bran and shelled corn fed in connection with clover or second-crop hay, or corn fodder; and for rough feed I think nothing better or cheaper than the latter, but it is well for variety to feed a little hay or sheaf oats. I have injured calves by feeding too much corn, and think a pound a day fed with the same quantity of bran enough to start with, but towards spring the amount of bran might be doubled. I would not have the corn ground for calves, if the grinding cost nothing, as their digestive powers are good, and there is less danger of indigestion when fed on whole corn than when it is ground. I place a high feeding value on bran, particularly for young, growing stock, as it has largely the same effect as grass in keeping the stomach and bowels regular, and enabling the animal to better assimilate other foods.

J. G. Oxer's Plan.—I think the best developed calves of their age that I have ever seen raised on skimmed-milk were on the farm of Mr. Oxer, of Preble County, Ohio. As he has been very successful with cattle, I asked him to contribute from his experience for this book, and I give here an article from his pen on the rearing of calves:

"The different modes of raising calves have an important influence upon their future existence, whether for the dairy, for the shambles, for breeding, or for the show ring, and in these days of long strides and great improvements a great many are fed for the latter purpose.

"In our experience of twenty years, if for the dairy, we do not force the animal, but after it is dropped it is allowed to remain with the dam until it is dry and gets a good draught of milk, after which it is taken from her and the dam turned with it morning and evening for six or seven days; if the cow does well, the calf is then moved out of sight, and taught to drink the milk instead of drawing it from the cow.

"To teach the calf to drink without much trouble is an important point, and the plan adopted by us is to feed very little

milk the first time or two. Three or four pints is enough, fresh from the cow. Have some one to hold the vessel. Have the calf tied or in some inclosure where it will have but little room. Seize it under the chin with one hand and put the other hand on its head, and force its mouth into the milk; and in its endeavors to release itself it is very likely to get a draught of the milk, and will soon take to drinking. Do not allow the calf to have the finger under any circumstances if it can be avoided, for the more they tug at your finger the more they want to. If the calf does not choose to drink the first time, do not worry it too long, but let it wait until the next feeding time. Hunger will soon get the best of it, and it will be only too glad to get its milk.

“The quantity and quality of milk are important considerations for the first few weeks. At the beginning very little skim-milk should be given, and that perfectly sweet. Calves are often made almost worthless by an indiscriminate feeding of milk in its various stages. Their stomachs are not in condition to digest such stuff, and they get the scours, become paunchy, the hair stands the wrong way, and their looks show that they have not been properly cared for.

“If our calves are dropped in the fall or winter, they are kept constantly housed in bad weather, and fed milk twice each day, as near the same time, morning and evening, as circumstances will admit of, regularity in feeding, both in quantity and quality, being a very important point. As soon as the calf learns to drink, we increase the skim-milk each day for a period of about two weeks. It is then three weeks old, and it is fed three to four quarts of warm skim-milk twice each day. The warm milk process is kept up until the calves are about three months old, after which time they are taught to drink cold milk by degrees, and the quantity is also lessened, until they are finally weaned, at from four to five months old.

“We always place a little hay within reach of our calves when they are but a few weeks old. It seems to be necessary for their proper development, and they very soon learn to eat it. Clover and timothy mixed seem to make the best ration. Clover alone is a little too loosening, and timothy a little too

binding. Fine Hungarian or millet is also very good. For summer feeding, about the same plan is followed, with the exception that the calf is allowed to run on grass, and is fed a little dry hay besides. Calves intended for milkers should have but very little, if any, corn during their growing period, for it always has a tendency towards too much fat. Wheat-bran, barley-meal, or plenty of beets, carrots, or mangel wurzel, will make a good ration in winter, after the calf is weaned. We have never tried the various hay teas and different kinds of gruels, for the raising of young calves, and think they should only be resorted to in extreme cases, to say the least.

“Calves that scour when young should be treated without delay, for if allowed to become chronic, it is much harder to check. First try a fresh egg or two in the milk. If that does not effect a cure, tie a half-pint of wheat flour in a rag and boil it for two hours. Let it dry, and pulverize a portion each time in the milk. In all cases calves should have enough suitable food to satisfy hunger, and plenty of water to satisfy thirst. For whatever purpose the calf is raised, strict attention to its growth and health will always pay, especially in these days of high prices.

“A calf intended for veal, should always have an ample supply of fresh milk from the cow—either fed directly after drawn, or allowed to draw the milk itself. If it is fed by hand, by shelling a small quantity of corn in the milk vessel, the calf will very soon learn to eat, and it is a great addition to the milk in forcing the calf. The writer has had some experience in buying veal calves, and it is very easy to distinguish a calf that receives all the fresh milk it can assimilate, and one that is fed partly on skim-milk. But the production of veals, we think, should not be encouraged, for the great increase in the demand for veal is having an injurious effect on the production of good cattle throughout the country.

“In raising calves for breeding purposes, a full development of all the parts is the main object to be sought. In such cases we almost invariably let the calf take the milk fresh from the cow, and very seldom let it run with its mother, but turn it

with her morning and evening, and after it has taken a proper amount of milk, if any remains, the cow is milked dry.

"The writer has attended so many sales of thorough-bred cattle, and seen so many splendid cows made almost worthless from spoiled teats, by allowing the calves to remain with them, and not paying proper attention to having them milked, that he considers it a very unprofitable practice. The calf should have, in addition to the milk, as soon as it is old enough, either hay or grass, shelled corn, or corn-meal and bran. We consider shelled corn a very necessary article of food towards a proper development of the animal. Some writers claim that bulls intended for breeding should never be allowed either corn or corn-meal as a part of their ration; but in our experience of a number of years, we have never seen any injurious effects arising from it.

"Raising calves for the show-ring we consider as unwise, to say the best of it. They are kept in the stable for months, and sometimes even years, with very little or no exercise, and fed, pampered, and nursed until they are made almost entirely worthless for any thing except for beef, and they are kept fat so long that they are not good for that. The writer, a few years since, in making a tour through the dominion of Canada, inspected a herd, a portion of which were kept especially for the show-ring, and as an advertisement of the herd. We were informed that they were kept constantly in the stable during the day, and only turned out for exercise of fine evenings, and the cows, such as would breed, almost as soon as they would drop their calves, were dried off, and the calf provided with another mother. It struck us as all being very nice, but entirely too expensive for the masses."

Pastures and Grazing.—With a calf of good stock, and well cared for until ready to go on grass, at six months or a year old (according to whether it is born in fall or spring), we have made a fair start towards raising a thrifty, well-developed cow or steer, and one that shall give a profit; but the same good management and judgment that has enabled us to grow such a calf, must be exercised in the further development of the animal.

To have good cattle, we must have good pasture, and to raise cheap beef, we must extend the grazing season as long as is consistent with a thrifty growth of the animal. The farmer who is able to keep his cattle on pasture, on which they will thrive, for an average of seven months of the year, will have a great advantage over the one who can pasture but five months. And the farmer who so manages that his cattle thrive and gain in weight during the entire grass season, will get a larger profit than he who so manages that his cattle for months barely hold their own. To insure, then, the greatest profit, the farmer will need early pasture, a variety of grasses or forage plants, so as to keep up a succession of food, an abundant supply of good water, shade, and some provision against severe drought. In a word, his animals should be comfortable, and every thing which tends to their comfort is profitable to the owner.

There should be on every stock-farm some permanent pasture of early grasses, and on all soils where it will flourish there is no variety better for this purpose than blue-grass. It starts very early in the spring, and it is not injured by tramping or short-cropping, and as its growth is rapid at this season it may be heavily stocked. It flourishes on rich or poor land, grows well in the shade, and will protect rolling-lands from washing better than any other grass. In ordinary seasons it may be pastured a month earlier than the stock should go on clover, and in cold, backward springs when, as in 1882, we have frost till the middle of May, we can sometimes gain six weeks by the use of this grass. For wet land, red-top will give the best satisfaction. I think it inferior in quality to blue-grass, but it is early and productive, and cattle eat it fairly well. Another early variety which will give excellent satisfaction is orchard grass. It is of rapid growth, has a broad blade which makes a large amount of food which is not surpassed in sweetness or nutrition by any other variety.

The farmer who makes grazing his leading interest, should seed a field with rye for the first pasture in spring, then turn on a field of permanent pasture seeded with one or more of the grasses named above, which should be stocked heavily enough

to have it eaten close by the time clover begins to blossom; then all the stock should be transferred to the clover, which will bear heavy stocking for two or three months, by which time the permanent pasture will have made a good growth for fall feed.

To provide against drought or supplement the feed when frosty nights come, he should grow some extra crops to feed the stock if needed, and there is nothing so cheap for this purpose as corn. I would not advise sowing it broadcast, or even drilling very thickly, as I think more is lost in quality than is gained in quantity, but it may be planted three or four stalks in a hill, and with hills eighteen inches apart, and the rows wide enough to admit the cultivator, and it will produce a large amount of food to the acre. It is better to begin giving extra feed before the pastures are too short and the stock checked in their growth. Pumpkins will be found cheap and valuable to be fed as the quality or quantity of the pasture deteriorates, and if the Connecticut field pumpkin is grown all that will be necessary will be to draw a sufficient quantity to the field each day, and scatter them on the grass, as the cattle can eat them without chopping.

It is folly to keep cattle out on pasture after the cold storms of winter have come, and the pastures are already eaten short, for under such management not only do the cattle lose flesh and begin winter at a disadvantage, but the pasture is injured, the roots being left bare and unprotected, and it will not only be later to start in the spring but poorer all the next summer for such management.

It is not safe to feed green corn to cattle in a field with hogs, as the latter will chew the husk and stalks, and reject the fiber which becomes indigestible, and if many of these cuds are eaten by the cows, they often produce impaction of the stomach, and cause inflammation and death. The owner should visit his cattle weekly while on pasture, and inspect them and note their condition. If salt is not kept in the pasture where they can have free access to it, which is probably the best plan, they should be salted regularly. If you find some that are unthrifty, it is better to cull them out and sell them for what they will

bring than to keep them, as it is a great deal wiser to sell an unthrifty animal at a small loss than to incur a greater by keeping it.

The Water Supply is a matter of great importance on a stock-farm, as cattle can not thrive if obliged to drink warm water from a filthy pool. If there is a permanent spring on the farm, by all means include it in your pasture, and if there is none, try and provide a supply of good water for the stock from some other source. A good well, provided with a wind-engine to pump the water, will pay for quite an outlay, or if a well is out of the question—as is the case in some localities, on account of the depth to which they must be dug, or the fact that permanent veins can not be found—a cistern may be dug and filled with surface-water during the wet season, and held as a reserve.

In many localities where there is a clay or limestone soil, these cisterns will hold without cement. I have two of them, holding one hundred and fifty barrels each, which may be simply called arched-wells. They are ten feet in diameter, and arched with brick, the arch resting on the natural ledge of limestone. They fill with water from the natural drainage of the soil, whenever heavy rains saturate it, and in the longest drought they retain water for two-thirds of their depth. In a porous soil, where the cisterns must be bricked, or stoned and cemented, a cistern would be expensive, but there occasionally comes a season in which the gain is so great that it will justify a heavy expense. Cattle that must be driven a mile or two through choking dust to fill themselves with warm river water once in twenty-four hours will be likely to lose flesh rapidly, and if this must be continued for several weeks, as is the case every few years, the loss on a moderate herd of cattle will go far towards paying for a cistern that would last through any drought likely to occur.

A supply of moderately good water can be had by constructing a pond if the soil is such as will hold water, and if not, it can sometimes be made so by drawing clay and puddling the bottom. A pond for stock-water should be made where there is

a gentle slope, so that there will be no danger of its being filled by wash from the fields. Do not make it over ten feet wide, and of such length as will be necessary for the amount of water needed; plant around it a double row of soft-maple trees, or some other quick-growing timber, to grow a dense shade for its protection, and fence it thoroughly, so that no stock can ever get into it. I would dig the pond east and west, and arrange at the east end for the stock to get at the water, as this point would not need so much shade. At this end set the fence a few feet into the pond, and make a gradual slope to the water, and cover it with broken stone or gravel to such a depth that the stock will not get into the mud. Such a pond could be dug with the plow and scraper at a moderate expense, and when the trees have attained a few years growth, the water would keep cool and wholesome.

Shade in every pasture is desirable, and the best way to secure it is to plant shelter-belts of timber along the north and west side of the field. These belts will not only furnish grateful shade during the heat of summer, but protection in spring and fall, not only for the stock, but also for the grass or grain crops. There are many days when the cattle are not comfortable in the pastures, if unprotected, and at such times these timber-belts would be of great value. It has been proved, that with one-sixth of the land planted in timber on the prairies, the other five-sixths produced as much grain as the whole did without the shelter, and there is no product of the farm that is likely to give so great profit in the future as timber, and if we can get benefit from it while growing, as well as a profit when it is marketed, there is a double motive for planting timber-belts. How to start these timber-belts is told in another chapter.

Winter Care of Cattle.—I have already in this chapter shown that bad wintering made unprofitable cattle. The wise farmer will, before winter sets in, take an inventory of his stock and resources, and if he finds that he has not enough food to carry his stock through in good condition, he will either buy food or sell stock. It is wise to do this in the fall rather than to wait till the latter part of winter, for the farmer who tries to

winter more stock than he has food for, is tempted to feed a little short in the hope that he may get through without purchasing feed, and his cattle will not be in a condition to bring a fair price in the spring; or if he must buy food, it is usually much scarcer and higher in price in the spring than in the fall.

There are a few fixed principles in feeding that the farmer should keep in mind. For example: it takes a certain amount of food to supply the waste of the system, and on this food there is no profit. This can be illustrated by the fuel burned under a boiler to generate steam to drive machinery. A moderate fire, which is not sufficient to bring the water to a boil, might be kept up all day and no power generated and no profit accrue, but a little more fuel added would start the water to boiling, and it would be easy to keep it so. If the animal is merely fed what will supply the waste through the winter, we have made no profit on the food, but the addition of a small amount of rich food will enable us to make a profit on all the animal has eaten.

Another fact is, that warmth and shelter are, to some extent, an equivalent for food. Or, in other words, one purpose which food subserves in the animal is to maintain vital heat, and food used for this purpose can not be used to replace waste tissue or add muscle or fat. I have an agricultural boiler which gives a good illustration of this fact. The boiler holds sixty gallons, and as it is one foot higher than the stove on which it is placed, and three feet in diameter, there is about nine superficial feet of surface exposed to the air. I find that on a cold, windy day it will take an hour longer and double the amount of fuel to bring the water to a boil if this surface is unprotected. There are farmers still who claim that cattle will do as well without as with shelter, and they refer us to the fine cattle that are fattened on the prairies as a proof of their statement. We grant that fine fat cattle are reared without shelter, but that does not change the fact that food used to maintain heat can not be used for any other purpose, and these same cattle would have been fattened on a much less quantity of corn if they had been protected. In a prairie country of cheap

corn and bad roads, it *may* sometimes be cheaper to maintain vital heat by additional food than by shelter; but to the majority of farmers there can be no question that shelter costs less than grain.

One other illustration: Every one knows how much easier it is to keep a fire up when the furnace is hot than to start it when every thing is cold. The same thing is true in the growth of an animal. If it is so wintered that growth ceases and the animal loses flesh, it is a slow process to bring it back to the point of profitable feeding.

There is much truth in the saying, "An animal well wintered is half summered." I have found that the cattle that are kept thrifty through the winter, and are so fed as to make a little gain, begin at once to thrive rapidly when turned to pasture, and before the starveling has shed its old hair, and shows signs of improvement, the well-wintered animal is good beef. The farmer who winters five cattle on the food necessary for four will, in a majority of cases, fail to realize any profit from them.

With perhaps some exceptions, I do not think the winter a favorable season for feeding for beef; but I shall speak of that under another head. But I do recommend such winter feeding as will keep the cattle thrifty, and bring them through the winter in such a condition as to make grazing profitable. For young cattle, and cows giving milk, I place a very high value on bran for winter food; but for dry cows, and two or three-year-old steers and heifers, I find nothing better for the grain ration than whole corn.

All things considered, in our best grain-growing regions, corn and straw will winter cattle cheaper and in better condition than any other food. The straw may be stacked so as to afford shelter, and the cattle allowed to remain day and night in the stack yard, or they may be stabled at night, and given the corn night and morning, and for a change a small feed of corn-fodder; but they will do well on corn and straw without other food. In this method of cattle feeding, corn can be used freely at a profit, from the fact that a large part of the nutriment in the corn is available for hogs after having passed

through the cattle. All who have tried the plan of feeding whole corn to cattle, and allowing hogs to follow, agree in giving it a high feeding value for the hogs, and the lowest claim made is that corn is worth half as much for hogs, after it has been fed to cattle, as it would be if fed directly to them.

Mr. John D. Gillett, who is one of the largest and most successful cattle feeders of Illinois, estimates that fifty dollars' worth of pork can be made from the corn fed to a steer during the two years from the spring it is a yearling, and that the steer will, in this time, eat two hundred and thirty-five bushels of corn, worth, at thirty-five cents a bushel, \$81.75. This estimate makes the pork pay considerably more than half the cost of the corn, and is made where the feeding is on what might be called the forcing plan, where the cattle are fed corn summer and winter from the time they are one year old till marketed. I accept this estimate of Mr. Gillett's with little question of its accuracy, as he has been largely engaged in the business of cattle feeding for many years, and few men have had as good a chance to ascertain the facts.

The farmer who grows wheat largely can, by utilizing his straw, winter cattle much cheaper than those who must feed hay. I am much inclined to doubt the economy of wintering cattle on hay alone, as is the practice in many of the dairy regions, for I think it not only better for the animal, but cheaper, to feed some grain or other food. If an animal is wintered on hay alone, unless it is of the best quality, it is impossible for it to eat and digest enough to furnish the necessary nutriment. A few pounds of bran and corn substituted for twice as many pounds of hay will give a ration more easily digested, more palatable, and better calculated to supply all the need of the system, and often at a less cost.

The proportionate feeding value of corn and good meadow hay is that of fifty-nine to one hundred. In round numbers, we may therefore say that a bushel of corn will be equal to a hundred weight of hay, or twenty bushels of corn to a ton of hay. At this rate, corn, at fifty cents a bushel, is as cheap a food as hay at \$10.00 per ton.

Feeding for Beef.—Perhaps there is no one branch of stock-farming in which farmers universally feel so great an interest as the feeding of cattle for beef, and none which, if a profit is to be realized, requires more skill and judgment, particularly if winter stall-feeding is attempted. The inexperienced farmer who attempts winter stall-feeding, is far more likely to lose than to make money by the operation, as many have found to their sorrow. There are different systems of feeding adapted to different localities, and the farmer must determine for himself which he will adopt. In the West, where land and grain are cheap, a system would prove profitable that would be ruinous on high-priced land, where it costs two or three times as much to produce a bushel of grain. In the new prairie countries no account is taken of the value of the manure, and under the system practiced but little benefit is derived from it, while among the truck farmers of the Eastern States manure is so valuable that farmers are willing to invest thousands of dollars in cattle and food in the fall, if they are sure of getting their money back in the beef, as they consider the manure a fair profit for the investment and labor.

Different Systems of Feeding.—I have spoken of Mr. Gillett, the great cattle feeder of Illinois. From a statement of his method of feeding, which I find in an agricultural paper, I should designate it as the forcing system. That he handles good stock will be seen from the weight of his yearlings, which he averages at seven hundred pounds. In the statement before me he does not give the details of the management of the calves, but states that they are fed no corn until one year old, and he puts the cost of a calf at this age at \$29, and its value five cents per pound, or \$35. I infer that the calves are allowed to run with the dams through the summer. At one year old he begins feeding corn, and for two years they are fed summer and winter all they will eat, and hogs allowed to follow them to eat the waste.

Mr. Gillett claims, under this system of feeding, that the steers will gain nine hundred pounds each from one to two years old, and that they will consume an average of one hun-

dred and ten bushels of corn each, worth \$38.40, and he estimates that five hundred pounds of pork will be made from the droppings, which, at an average price of five dollars a hundred, pays \$25, or more than five-eighths of the cost of the corn. The cattle now average sixteen hundred pounds, and are worth \$6.50 per hundred, and the profit on this year's feeding he estimates at over \$50 per head. From two to three years old, each steer consumes an average of one hundred and twenty-five bushels of corn, and gains but six hundred pounds, and the profit this year he estimates at about \$19 per head, the cattle now being worth \$7 per hundred.

It will be seen from these figures that if the supply of this quality of cattle was unlimited, a much greater profit could be made by marketing at two years old, as it takes fifteen bushels more corn to make six hundred pounds gain on a steer from two to three years old, than to make nine hundred pounds on the steer from one to two years old. As, however, \$19 is a paying profit, and the supply of choice cattle is limited, it pays to keep them over till three years old. These figures show how much is gained by early maturity, and this is the quality of greatest value in our improved breeds of cattle, and it has been proved in thousands of cases that good grades of these improved breeds will be as heavy and ripe for the butcher at two years old as common cattle at three.*

Perhaps some farmer will criticize these figures and say, "How is it that Mr. Gillett counts with such certainty on \$6.50 and \$7 per hundred for cattle? Is not the price of beef subject to fluctuation like other products?" Yes, my friend, the price of old cows, scrub steers; that weigh from six to nine hundred, stags and "Pennyroyal" stock goes up and down in the market, continually vibrating between \$1.75 and \$5 per hundred pounds, but smooth, ripe steers, that will average sixteen hundred pounds, vary but little in price, unless it is in a time of great scarcity, and then the price advances, but the

*Since the above was written I understand that Mr. Gillett has determined to market his cattle at two years old, as continued experience has shown him that the greatest profit is found by handling cattle so as to mature them at this age.

market is never over-stocked with them, and the price rarely, if ever, gets below the figures named.

For a year past I have heard marvelous stories concerning a steer raised by Mr. Oliver Keffer, of Union County, Indiana, a man of large experience in feeding and handling cattle, and wishing to know the truth I wrote him asking that he would give me the facts about it. In reply, Mr. Keffer writes as follows :

“DEAR SIR,—The steer you ask about I bought when he was three months old, paying \$12.50 for him. I sold him when thirty-four months old, at which time he weighed two thousand one hundred pounds. He was shipped to Pittsburg with five others that averaged eighteen hundred and fifty pounds, and the lot sold at nine cents per pound. I could have sold this steer alone for ten cents per pound. This statement you can rely on.

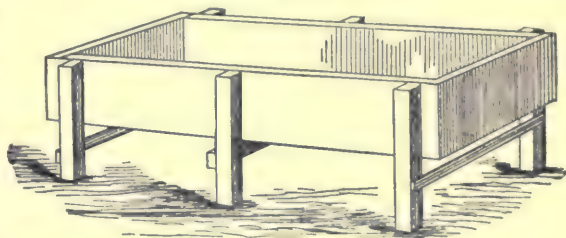
O. KEFFER.”

The Labor-saving System of cattle feeding is practiced to some extent, and is, perhaps, not without some advantages. Under this plan corn is kept before the cattle all the time after they are on full feed. Pastures are allowed to grow up to furnish rough feed for a part of the winter, and straw-stacks are provided to which the cattle can run when the grass is covered with snow. Feed-boxes are placed high enough so that the hogs can not get into them, and in these corn is always kept so that the cattle can help themselves. If at any time soiled corn is found in the boxes, it is shoveled out to the hogs that are allowed to follow the cattle. The labor of feeding cattle is thus reduced to a minimum, and one man can in a very few hours do all the work necessary for a week for a large lot of cattle, as a load of corn at a time is shoveled into the boxes. It will not answer to begin this heavy feeding at once, as the cattle would injure themselves by over-eating, but begin with a small quantity of corn and gradually increase until the cattle leave some in the feed-boxes, and then fill them up and allow the cattle to help themselves.

I have never tried this plan, as I prefer stall-feeding, so as to save the manure, but a neighbor who has practiced it for

years, tells me that his cattle do remarkably well, and that there is no waste of corn, as the hogs eat all the cattle reject. I think the best form of feed-box for out-door feeding is one large enough to be used for shock corn if desired. The cut shows its form.

Use four by four inch scantling for posts; cut them three feet long. Six posts will be needed for each box, and I recommend that the boxes be made five by ten feet. Spike two by four scantling one foot from the top of the posts, across from one to the other to support the floor.



FEED BOX FOR SHOCK CORN.

When completed you will have a bin one foot deep, on legs two feet high. Its size will be sufficient to hold a feed of shock corn for four to six cattle, and its width such that they can easily reach to the middle of it. It will hardly be possible for the cattle to tip it over on account of its width. It will be high enough to keep the hogs out, and can be easily moved on a sled. About one hundred and twenty feet of lumber will be required, and if this can be had for two dollars a hundred, the cost of the box complete should not exceed three dollars. A few of these feeding boxes would be convenient on every farm. They could be used in the pastures in spring or fall, when a little extra feed is needed by the stock, and would prevent the tramping and waste which is so common when cattle are fed on the ground.

Stall-feeding of Cattle.—More labor and care is required to feed cattle successfully in the stable than by the methods already described, but there are also advantages connected with this plan. With a properly constructed stable all the manure can be saved, and on many farms this alone would be considered good pay for the labor. With cattle warmly sheltered, less food will be required for each pound of flesh gained, as less will be expended in keeping up vital heat. The amount of food to

each animal can be regulated, and the weaker animals can be given their full share, which is not the case when fed in feed-lots. An opportunity is given to try experiments with different foods, or, by weighing the food for a given time, and the animal before and after the experiment, and this enables the feeder to find out valuable facts concerning the amount and kind of food to give. By confining the animals in stalls, we greatly economize shelter, as at least three animals can be sheltered, when tied, in the space that would be monopolized by one loose.

I give here an article from the pen of J. G. Ozer, who has been a successful stall-feeder of cattle.

Feeding Cattle.—"As the demand for good beef, both in this country and Europe, is steadily on the increase, the subject of feeding cattle, or the production of good beef becomes more and more important to the farmers of this country each succeeding year. How to produce the most and best beef with the least possible expense, should be the aim of every one engaged in the raising of cattle, and one of the very essential points is to have a good beef-producing breed to begin with. The writer has had considerable experience in feeding the various breeds of cattle for market, and finds a vast difference in the growth and feeding qualities of the good grade Short-horn and the common scrub. Cattle intended for the shambles should always have a plentiful supply of good food, no stinting or starving to make them hardy, as some say.

"It is no uncommon occurrence to see cattle no larger at three years than they should be at twenty months or two years, and this is generally caused by the starving process during the first year, when the animal is too young to take care of itself among a herd of older cattle. The old maxim, that 'what is worth doing at all is worth doing well,' holds good in this as well as all other occupations. As stated before, to derive the greatest profit the animal must be kept growing from birth until it is slaughtered. In this article we will give mostly our own experience.

"Should the calf be dropped in the fall, it is either fed by hand on good sweet milk for the first five or six months, with

shelled corn, bran, oat-meal, and hay in addition as soon as it will eat; or if allowed to take the milk from the cow, it is turned with her twice a day, with the same food in addition as in the case of feeding by hand. In the spring, when turned out to grass, the same process of giving dry feed is kept up at least once each day, until the grass loses its washy nature. Calves dropped in the spring are treated much the same. As soon as pastures begin to run short in the autumn, the feeding is commenced again, and when bad weather comes on, the calves are brought to the stable and not permitted to roam over the fields in quest of food until grass comes the next season.

“The best food for yearlings is an equal mixture of shelled corn, or corn-meal, bran, and oats; the corn to make fat and keep up animal heat, bran and oats to make bone and muscle. The amount that each animal should have varies so much at different times, that it is hard to give an estimate; when it is steady, cold, and dry, they will eat much more than when the winter is warm and wet. Some writers claim, that three pounds of solid dry food for each hundred pounds the animal weighs is amply sufficient, but it won't always hold good. The second spring, when the cattle are turned to grass, they are fed the same as at first, until they become thoroughly accustomed to it and no danger of scouring. Many good animals are badly injured by too sudden a change from dry food to grass in the spring of the year. A little dry food each day, if it is nothing but hay or good straw—with salt—in small quantities, two or three times each week will prevent scouring and keep the animal in good condition.

“The second winter, if cattle are intended for the shambles the following spring or summer, we begin the feeding process in time to keep the animals from losing any flesh; but in the change from green to dry food it is impossible to keep them from shrinking in weight for a period of three or four weeks. The cattle are stabled at the beginning of bad weather, each animal is tied by itself and fed lightly the first few days, as the sudden change from out-door exercise to being tied in the stable causes a little excitement and a high pulse, and we always find the result more satisfactory to feed lightly until the animal becomes

thoroughly accustomed to the change, then increase each animal's rations to all it will eat with good relish.

"Our feed for fattening cattle is principally corn or corn-meal, with a little bran. I am a thorough believer in the efficacy of corn as a fat-producer. We always feed twice each day, as near the same time, morning and evening, as possible. Hay is fed in such quantities as will be eaten clean and with a relish, twice each day, and soon after the morning or evening meal. Have always practiced watering but once a day while the cattle are kept in the stable. If the weather is not too inclement, the cattle are turned out in a lot adjoining the stable, for two or three hours each day, and they are supplied with plenty of water freshly pumped. The same rules are followed as in feeding. They are always watered about, or just after the middle of the day, after the cattle have had ample time to digest the morning meal. After an experience of several years with the various grasses and corn-fodder, I think a mixture of three-fourths clover, and one-fourth timothy, gives the best results, for the expense in producing it, of any roughness that can be given.

"I have tried various plans of fastening cattle, and for animals that weigh under one thousand pounds, prefer the stanchion, but heavier cattle do much better to be tied around the neck or head, in order to have more freedom in lying down and getting up; and it is a fact beyond dispute, that cattle will be much better satisfied tied around the neck than around the head.

"Cattle should be fed at least twelve or fourteen weeks for profit and by actual test, I have always found them to make the greatest gain the last three or four weeks of feeding. An animal in good flesh will gain much faster than one in thin flesh.

"There is no rule that can be laid down as to when is the best time to dispose of fat cattle, but when they are thoroughly ripe for the butcher, and the price is such that there will be a fair profit for the outlay, is a very good time to sell.

"A few thoughts as to the proper time to purchase cattle for stall feeding. If intended to be turned to the butcher from the stable, I have always practiced buying about, or just

before, the holidays; the cattle are then generally well shrunk out, pastures are becoming short, prices are usually low from an over-crowded market with stock to be got off before the weather gets too bad and the stock runs down thin in flesh. A few day's feeding soon starts them to gaining, and they improve right along. If I intend to graze awhile then I prefer waiting until February before making purchases. They usually advance a little by that time, but the shrinkage in weight from a scant supply of food, which is practiced by so many farmers, usually over-balances the advance in price. Cattle can then be fed three months, turned to pasture six weeks with three or four quarts of corn-meal to each animal a day, and they are in prime condition to be slaughtered.

"No statement has been made thus far in this article as to the amount of corn or its equivalent required for fattening an animal. I have always fed from fifteen to eighteen pounds pure meal each day, or from twenty to twenty-five pounds of corn and cob-meal, or corn on the cob, which for a period of one hundred days would make about thirty bushels of corn to each animal. The above is an average for cattle weighing from eleven to thirteen hundred pounds; have never weighed the hay, but as stated before, fed what would be cleanly taken up. Results in gain for a period of about one hundred days in stall feeding have run from two and one-fourth to three pounds per day. A steady, cold winter, with good cattle, the average is usually about two and three-fourth pounds.

"Finally, get a breed that will fat. Keep them growing continually. It is wretched policy to let an animal lose flesh, for every pound costs money, and it will cost money to replace it. One who pays twice for a thing is reckoned unfortunate, but farmers often pay several times for the same pound of flesh. If the above method could be thoroughly inaugurated, it would lead to good results in the production of beef."

While I like stanchions, and would have them in every stable in which I was intending to tie cattle, I would never leave cattle to lie all night in this position, for it is unnatural and can not be comfortable. With the stanchions attached to each

other by a light strip of board, quite a row of cattle can be fastened or unfastened by a single motion of the hand, and on this account, and as they cost but little, I recommend that they be put in all cattle stables; but in addition I would have a short rope and snap for each stall, and a strap or short piece of rope with a sliding ring on it round the horns of each of the cattle. The feed can be put in the boxes and the cattle let in and secured by the stanchions, and then at your leisure each one can be fastened and the stanchions thrown open for the night. While they are eating in the morning the stanchions can be closed again and the snaps loosened, so that when you wish to let them out you can do it quickly and easily. There is always some trouble and risk of being hurt by the horns in tying animals, and this is greatly reduced by first securing their heads in the stanchions. I have never found a tie so satisfactory as the snap and ring. With good, strong snaps it is impossible for them to get loose, and the time required to fasten or unfasten an animal is not longer than it takes to snap your fingers. If the rope or strap round the horns can be secured so as to keep the ring in the center of the forehead, it will be an advantage.

For steers or fattening cattle I prefer the box stall, and if one has room so as to allow the animal a stall large enough to turn round in, it will be all the more comfortable, but a stall so narrow that the animal can not turn, with a single bar to keep it from backing out, will answer the purpose. This bar can be hung on a pivot by a single bolt through it so as to turn it up when open, and when closed it can be kept in place by a wooden pin or some simple form of latch, which can be easily arranged.

I do not think an animal can be so thrifty with its flanks and horns covered with tags, or plastered with dung, and I have never been able to keep cattle clean except on a raised floor or with a manure ditch. I prefer the latter, and make it eight inches deep and two feet wide. It should be water-tight, and where tough clay can be had, all that will be necessary will be to make it fifteen inches deep, with sides of good two-inch plank, and pound six inches of clay in the bottom, and on this lay a board floor to give a smooth, solid bottom. If clay can

not be had fill the bottom to a depth of six inches with broken stone or coarse gravel and pound it down well, then pour in a grout made with one part of cement to four of good sharp sand, and after it has set, use an inch coating composed of two parts of sand to one of cement, and mixed to the consistency of mortar for plastering. There should be a floor laid on this, but it may simply be two boards, each a foot wide (so they will fill the space), laid in loose. It will require but little bedding to keep your cattle clean on such a floor as this, as, if it is of the proper length, most of the manure will drop into the ditch. We always keep a hoe hanging behind the cattle, and every time we visit the stable if there is any manure on the floor we scrape it down into the ditch.

The length of the floor will depend on the method of fastening and the size of the cattle. If their heads are kept in the stanchions the floor may be a foot shorter than if tied. I use in my cow-stable a floor five and one-half feet long, and find it long enough for the largest cows, and I have some Short-horns that weigh fifteen hundred. I think four and three-quarter feet long enough for common cattle of from nine to twelve hundred pounds each and five and a half for large steers. I allow four feet of width for each cow, and have plenty of room to milk, and think that box stalls three and a half feet wide in the clear would be ample.

There is no material for bedding that I have ever used which keeps the cattle so clean or gives as good satisfaction as sawdust; and when I can get it within five miles by paying fifty cents a cord for it, I use no other bedding. I keep the ditch as well as the floor littered, so as to absorb the liquid. It is best to clean the ditch every day and wheel the manure to the barnyard, but in case of bad weather, or a press of other duties, a ditch of this size will hold the manure for three days.

If one was arranging a new stable and intending to go into the business of feeding cattle on a large scale, two rows of cattle might stand with their heads from each other, and have the floor between them eight inches lower than that on which they stood, and wide enough to drive through with a wagon or

cart, and the manure could be taken directly from the stable to the fields. This would save much labor in handling the manure. I saw at Elgin, Ill., a dairy-barn, in which sixty cows were kept, that was arranged in this way.

Where a large lot of cattle are to be foddered in the barn, the arrangements for getting the rough feed to them should be as convenient as possible. If hay or fodder for thirty head of cattle must be forked down a narrow hole, and then lifted three or four feet and crowded into a narrow manger, and this repeated three times a day for many months, it involves a large amount of hard work.

The most convenient method of feeding that I have ever seen, is to arrange the stables around the barn-floor so that the cattle stand two and a half or three feet lower than the floor, and eat directly from it. With such an arrangement there will be no lifting of hay or fodder, but with a rake or fork it can be pushed to the cattle. If building a cattle-barn, I should adopt this plan, as I think it would be both convenient and economical. The loft-floors above the cattle should be dropped as low as could be done without detriment, so as to give the room above for storage; and if the cattle stood three feet lower than the barn-floor, the loft-floors need only be raised four feet above the level of the former, to give a ceiling seven feet high in the cattle stable, which would be ample, as there would be a supply of air from the barn-floor. The grain or meal can be fed directly on the barn-floor by fastening a narrow board eighteen inches from the edge of the floor to prevent it being pushed beyond their reach. A strong board, six inches wide, will be needed at the edge of the barn-floor to prevent the cattle from pulling the hay or fodder under foot. If the cattle are fed in a basement, and a manger used for fodder, I would make it wide enough so that a man could walk through it comfortably carrying a bundle of fodder, or with his arms full of corn-buts. If the studding on the side next the cattle lean a little towards them, I think two feet is wide enough at the bottom.

I do not like feed boxes in the manger, as they are in the way, and the cattle, if fed meal, will always waste more or less,

which drops outside the boxes, where they can not reach it, and becomes sour. I prefer to make the bottom of the manger tight enough to feed meal, and have no divisions in it, but so arranged that it can be swept, with nothing to interfere with the broom, from one end to the other. If the manger is made of dressed lumber, and is two feet wide in the bottom, the cattle can reach every part of it, and can eat meal or corn from the floor of the manger as well as from a box, and there will be no difficulty whatever in keeping it clean. In a basement barn the mangers can be arranged so that the hay and fodder can be dropped down to the cattle through trap-doors, which can be closed after feeding. If grain and meal are kept on the upper floor, a wooden spout can be arranged to convey this food to each animal and much labor saved.

Feeding.—The reader will recollect that I am now speaking of feeding for beef, not milk, and while many of the directions given will apply to all cases, I yet make quite a difference in feeding for the butcher or the dairy. After some years of experience, I am well-grounded in the belief that it does not pay to grind corn for feeding to beef cattle. I have always found more danger of indigestion and scours from feeding meal than from whole corn, and while the cattle will digest more of the meal, I think it cheaper and better to feed whole corn, and allow hogs access to the dung, than to be at the expense of grinding.

The most successful feeders of my acquaintance feed whole corn. The experience of Illinois cattle-feeders shows that shock-corn furnishes a perfect ration for fattening cattle, and it is claimed that when the corn is eaten with the husk and fodder, that it is raised and remasticated in chewing the cud. I am of the opinion that it would pay much better to get a good power-cutter, and cut up the fodder and corn all together, than to husk and grind the corn, and feed it and the fodder separate. One advantage of this would be, that the refuse of the fodder would be in a good condition for bedding for the cattle, and would make an admirable absorbent for the liquid manure. I think the cattle would also eat a larger per cent of it than when fed long, and I have the testimony of dairymen who have tried it, that their

cows do better on it. I visited in 1876 a dairyman at Elgin, Ill., who milked sixty cows and used corn-fodder exclusively for rough feed in winter. He told me that he made repeated tests, feeding his cows first on long fodder and then on cut, and he found that the cut fodder gave eight gallons more milk per day from the sixty cows. The cut fodder was fed dry, with no meal or grain mixed with it.

I have found so much trouble in feeding corn-meal, that I always, when I use ground feed, mix bran with the meal, as I find it makes a much more palatable and easily digested ration than corn-meal alone.

In all stall-feeding, regularity, both as to time and quantity, is of great importance. A single over-feed will cause the loss of a week (often more), and if this is repeated a few times, the animal becomes predisposed to indigestion, and will likely be unprofitable. There is no department of farm work that I have found so difficult to intrust to hired help as the feeding of cattle. The novice in stall-feeding will be more likely to lose than to make money, unless he has studied the details well, and gives his personal attention to them. The points in which he is likely to err are: 1st. In getting cattle that are not good feeders. 2d. In too heavy feeding at the start before the cattle are prepared for it. 3d. In beginning to feed at the wrong season, which will involve feeding too long. 4th. In not exercising good judgment in selling.

It requires judgment and experience to select good feeding cattle, and if one is conscious that he is lacking in either or both, it will pay to get some one who understands the business to select the stock for him, particularly if buying in winter, expecting to begin feeding at once. If he has pasture and plenty of rough food for wintering the stock, he can buy during the summer, selecting those which prove to be good feeders and disposing of the others before winter. In this way, one with but little knowledge of the business can get a good lot of cattle. Every feeder or dealer in cattle should have stock scales, and weigh frequently, that he may know how his cattle are gaining, and also to enable him to become expert in judging the weight

of cattle. The scales will tell you what animals are gaining the most, and these are the ones to keep for feeders. If you find that you have cattle that are not gaining, or that are gaining but little, the sooner they are sold the better.

A common mistake with the beginner is to take an animal from the pasture in the fall, or, perhaps, a month or two later, when it has been at the straw-stack, or on stalk-pasture, and begin heavy grain feeding at once. This is almost certain to result in indigestion and loss. Our experienced feeders do not expect to get their cattle on full feed under a month, and even a longer time is recommended.

I think it a mistake to buy cattle in the fall from the pastures to feed for a spring market. In the transition from grass to dry food they will lose weight unless grain feeding is begun at once—and even then it will be difficult to make them gain much for a month—and to feed from the first of November till spring is too long a time, ordinarily, to stall-feed at a profit. Occasionally a lot of cattle can be kept in stalls on full feed for a longer period than one hundred days, but, as a rule, it is not advisable to try to feed longer; and I think there can be little question that the chances for increase of weight, and also for a paying price, are better if this term of one hundred days begins in mid-winter rather than in autumn.

If cattle are to be sold in December, feeding should begin before they are taken from the pasture, and they should be so managed that they will not feel the transition from grass to dry food. If, however, they are to be fed for a spring market, it is considered a decided advantage that they should have but little grain for a few weeks after leaving pasture. They should not be allowed to get poor, but should be fed well on hay or corn-fodder. This is what feeders call “getting the gross out of them;” and just as a hog that has summered on a diet of clover is in a better condition to take on fat than one that has made an equal or greater growth on a corn diet, so these cattle will have their digestive organs in such a condition that they will bear longer and heavier feeding and give better returns for the grain. I think this of special importance when one is buying cattle to

feed, and that he can well afford to pay half a cent a pound more for good cattle the first of January than the less price for the same cattle two months earlier.

The novice will need to keep a sharp lookout in selling his cattle. As a rule, I would advise against contracting them beforehand. It is the safer rule to keep control of them, so you can sell when you wish. If your stock is sold to be delivered the last of May, and the scales show in April that they are not gaining, you will be obliged to keep them for a month, probably, at a loss. Keep well posted on the value of cattle, and do not take the butcher's or drover's word for it. If you have a car-load of good cattle it will perhaps pay you to take them to an Eastern market; but that is a matter to be determined at the time. You must take shrinkage into consideration, if you ship. I have learned from a feeder who has had considerable experience, that he loses more from shrinkage when he ships to Cincinnati, which is sixty miles distant, than when sent to Pittsburgh, which is three hundred miles away. He accounts for it in this way: Those shipped the shorter distance are just long enough on the way to get well emptied. They do not get over the excitement and worry of loading and unloading, and are sold at once without feeding. Those shipped the longer distance are unloaded and fed before they are put on the market, and make up a part of the shrinkage.

Experience shows that it is not profitable to turn cattle on grass in the spring if they have been full-fed for some time and are to be sold as early as June, as the young grass will be likely to scour them, and they will lose flesh rather than gain, and not be in as good condition for selling as if kept upon dry food.

Grass and Grain Combined.—I have had considerable experience, for a few years past, in feeding cattle for a June market, and have found that I could make a greater gain in flesh at this season of the year than any other, and consequently I have realized greater profit. I find that under proper management I can, in from ten to twelve weeks, with only a moderate amount of grain, make fair beef out of old cows and indifferent stock which would be very hard to fatten at any other

season of the year, and with good thrifty steers the gain in flesh is very rapid. My greatest success in cattle feeding has been by beginning to feed grain about the first of March and feed lightly, but enough so that I can see some improvement, and as soon as the pastures are good, turn to grass. Cattle managed in this way will not be injured by the transition from grain to grass, as those will which have been for months on full feed; but the start the grain has given them will be a great benefit, and enable them at once to begin to gain and thrive, and a few weeks' grazing makes them salable. I have often bought cows and heifers that were very thin in flesh the first of March, and fed them each ten bushels of corn, or less, then grazed a month, and sold to the butchers at a price which paid one dollar per bushel for the corn and from five to ten dollars a month for pasturing. The advantages of this plan of feeding are many, and I can recommend it with great confidence. I often find that I can make the most money from my pastures by stocking heavily at this season of the year, and then selling off the stock, so as to leave the pastures but lightly stocked for the rest of the season. This leaves the roots well protected and insures early pasture next spring.

I find March and April the best months for feeding roots to cattle, and I have been able to fatten old cows cheaply by feeding roots and meal for six weeks before turning to grass. If we look at the matter carefully, we shall see several reasons why we may expect a large profit from this plan of management. First, the grain feeding which I recommend gets the animal into a thrifty condition so that no time is lost, but when turned on pasture they begin at once to take on fat. Second, this is the natural season of rapid growth for animals and vegetables, all the conditions being favorable. The cold storms of winter are past, and the oppressive heat of summer, with its swarms of flies and other tormenting insects, has not come. Water is pure, cold, and abundant, and the growth of the grass is so rapid that the pastures will bear heavy stocking. I think it safe to put double the number of cattle on a pasture, if they are to be taken off in June, that should be turned on it

if they must get their living from it all summer. One other advantage is that the best market of the year—particularly for common beef cattle—is usually at this season. The cattle that have had six weeks of grain feeding before going to pasture will be ready for the butcher a month sooner than those wintered without grain and turned to pasture when they are poor; and in an experience of many years I have always found the best demand and prices for this class of cattle in May and early June, and I have often seen the price drop a dollar per hundred as soon as grass beef was plenty.

I have been in correspondence for some years with an Illinois cattle feeder, Mr. Samuel Deal, of McLean County, who has fed cattle at a large profit since he adopted the plan of spring and summer feeding. I was led to open a correspondence with him from seeing a statement of the gains and profit on a lot of sixty cattle, which he fed in 1878, and accompanying it was the statement that for several years he had tried winter feeding and had not found it profitable, and that since he had adopted the plan of spring feeding he had not in a single instance failed to make a large profit. As this corresponded with my own experience, I have been greatly interested in the reports of his success, which he has kindly furnished me from year to year. It is perhaps not out of place for me to say that though I have never met Mr. Deal, I learn from those acquainted with him that he is a man of strict integrity and his statements can be relied on as accurate. Accompanying the statement of the weight, gain, and profit of the different lots of cattle he has fed during the last six years, was the following statement, which he prepared in February, 1883, after an experience of six years in spring feeding:

Summer Feeding of Cattle.—"The majority of farmers consider grass sufficient for cattle in summer and confine their grain feeding to the winter months. I have found a large profit from feeding grain in connection with grass, and that each supplemented the other.

"I find, first, that it takes only half as much corn to fatten an animal when on grass as when fed in winter on dry feed. It

also takes much less grass for the corn-fed cattle, and I find that a pasture that will furnish grass for one car load of cattle only when they are fed no grain, will be sufficient for two car loads when fed grain.

“Second. The gain of cattle is uniform in summer feeding, as you do not have the storms to contend with which winter brings. I have often in winter fed with the greatest care for one or two weeks in bad weather, and felt well satisfied if my stock had not actually lost flesh, and it is not uncommon for three weeks to pass without gain, when the cattle were eating over half a bushel of corn each per day. It is considered good feeding to make an average gain of two pounds per head each day in winter feeding, and to do this requires good stock and the best of care and heavy feeding. The statement of weights below will show the gains I have been able to make by combining grass and grain feeding.

“Third. In winter feeding there is danger of over-feeding producing indigestion and consequent loss of appetite and flesh, and with the utmost care there will be loss from this cause. In summer feeding we do not have this trouble, for the cattle when full of grass will not eat corn enough to hurt them. In summer feeding I find the cattle will eat an average of a peck of corn a day. We feed at night in boxes in a feed-lot, as we find the cattle will come to the lot with more regularity and certainty then than at any other time of the day.

“The profit on the hogs that follow the cattle pays, on an average, for the pasture and half the corn, and in exceptional years of high prices of pork I have had it pay for pasture, corn, and interest on the money invested. Below I give a statement of the time of feeding, weights, amount of corn fed, etc.:

“1877.—Fed 55 steers. Put in feed-lots February 17th and fed lightly for five weeks, but got them on full feed by the first of April. Fed one peck of corn per day to each on grass, and sold the latter part of June, after 129 days feeding. Cattle weighed 1,010 pounds each when put up, and 1,429 when sold, making an average gain of 419 pounds, or about 3 $\frac{1}{4}$ each per day.

“1878.—Fed 64 head. These cattle were quite thin, and

averaged 1,000 pounds. Began feeding as before, in February, and after the first of April gave them all the shock corn they would eat till turned on pasture. Then fed as before. Sold in August, when they averaged 1,536 pounds. These cattle were worth when put up to feed, \$3.50 per hundred, or \$35 each, and were sold at \$4.50 per hundred, bringing \$69.12 per head. After allowing the regular rates for pasture, market price for corn, and eight per cent interest on capital, there was a net profit of over \$1,100 on the lot.

"1879.—This year 89 head were fattened on the same plan. They cost \$2,775 and were sold in two lots, the heaviest cattle July 16th, at \$5 per hundred, and the lighter on September 10th, at \$4.75 per hundred, bringing \$6,974.

"1880.—One hundred and thirteen cattle were fed which cost \$4,048. They were sold in three lots, the first, forty-eight head, in June, as many more in August, and the balance in December, the lot bringing \$8,057.99.

"1881.—Fed 103 head costing \$3,090; sold 85 head July 15th at \$5.25 per hundred, and the remainder at Christmas at \$4.75 per hundred, the lot bringing \$7,152.41.

"1882.—Sixty-nine head; weight, May 1st, average 1,036 pounds; June 1st, average 1,169 pounds; making a gain of 4½ pounds per day. July 1st, average 1,261, making a gain of about 3 pounds per day. July 18th, 34 head were sold averaging 1,346 pounds, and the remainder were kept till November, when they averaged 1,470. The lot at \$4.50 per hundred were worth when I began feeding \$46.62 per head, corn was worth 60 cents a bushel, and those sold in July ate a little over 19 bushels each, worth \$11.85, and were charged for pasture 2¼ months \$4 each, making the total cost \$62.47 per head. These cattle sold for \$6.70 per hundred, being \$90.11 per head; deducting cost, leaves a net profit of \$27.64 per head. The cattle sold in November brought the same price per hundred, which amounted to \$98.49 per head, but no account was kept of corn or pasture after the first lot was sold."

The last letter received from Mr. Deal was dated June 7, 1883, in which he says:

“I am feeding sixty-eight head of steers this year and have just weighed for the first time since we turned to grass, and find that we have the largest gain we have ever made in the same time. May 5th, the lot averaged 999 pounds; June 1st, 1,136, making a gain of over five pounds each per day.”

Mr. Deal's figures would be more satisfactory if he had made a full statement of each year's feeding instead of merely giving results, but it seems to me they are sufficient to show that he has found out how to feed cattle at a profit, for during a series of years, including both high and low prices of corn and cattle, he has made a large and uniform profit. His report also, as far as it gives weights, shows that the greatest gains were in the early part of the season.

Knowing that “in the multitude of counselors there is safety,” and that farmers are always glad to read a record of practical experience, I wrote to Mr. A. Jarrett, of McLean County, Illinois, whom I knew to be a successful cattle-feeder, and a man whose statements could be relied on, and in reply to my questions received from him the following:

“I have fed cattle of different ages—one, two, and three years old. I prefer three-year old steers that will weigh about twelve hundred pounds each, as they fatten faster than younger cattle, but large, thrifty, two-year olds will do very well. If wanted for the spring market, I buy in the fall and let them run on stalk pastures as long as I can to keep up their flesh, then feed lightly till the first of March, by which time I get them on full feed. The length of time I feed depends greatly on the market. I sometimes start intending to feed only three months and feed five. In winter I feed shock corn once a day. I think they do better on it than on husked corn, as it does not dry out and get so hard, and the cattle waste less when fed in this way than when husked. I consider corn-fodder a better rough feed for cattle than hay. I feed shock corn in what are called feed pens, made of poles fourteen or sixteen feet long, and five feet wide, with a tight floor eighteen inches below the top. This is much better than feeding on the ground, as it prevents tramping and wasting the corn, and the stalks thrown out

around the feed pens soon accumulate so as to keep the cattle out of the mud and also save the manure, which I find in fine condition for the land the next fall. I do not furnish shelter, except straw stacks. I stack my wheat and rye straw in the feed lots so as to afford good wind-breaks and a dry, clean place for the cattle to lie. I do not feed hogs and cattle in separate lots, alternating them, as is the practice of many feeders, but make my feed pens high enough to keep the hogs out, and let hogs and cattle run together. I have a separate lot for the hogs to sleep in, as the cattle are likely to tramp them and injure them in cold weather when they burrow under the straw.

"In summer when the cattle are on pasture I feed ear corn. I break the large ears into three pieces, as there is less waste than if fed whole. The cattle when on grass usually shell off the corn and reject the cob, and I am of the opinion that it would be better to feed shelled corn.

"For a late spring or early summer market I begin feeding from the first of February to the first of March, depending on the weather and the condition of the cattle and the stalk pastures, as I do not want the cattle to lose any flesh.

"I have in exceptional cases made a gain of one hundred pounds per month per head on a bunch of steers, but I consider two and a half pounds a day in winter and three pounds in summer very satisfactory. The spring of the year generally gives us the highest prices for beef, but it costs more to fatten for a spring than a summer or fall market, and the best time to sell cattle may be said to be when they are ripe.

"Cattle that have been on full feed will usually fall off in flesh when turned to grass without corn, and even if fed corn they make but little gain if any for two weeks. If the feeder does not expect to hold his cattle six weeks or two months after grass comes, he will do better not to turn them to grass at all.

"The value of the corn for hogs after it has passed through the cattle varies greatly. If the corn is sound and hard, and fed in good, dry lots I think it equal to fifty per cent of the first cost, but when light, chaffy, soft corn is fed it is worth

very much less. I have had seventy-five hogs follow thirty-four cattle and make a fine growth. It is not best to try to fatten hogs with cattle, as if full fed they do not eat the waste corn clean. When growing corn to feed to cattle from the shock I plant considerably thicker than is the common practice, as it gives smaller ears for the cattle, and besides I think it not only handles better, but gives more feed to the acre. There is quite a difference in steers as to the amount of corn they will eat, but two-year olds on full feed will eat about a peck a day on an average, and three-year olds a half more.

“Notwithstanding I do not house my cattle, I believe it would pay, and I am contemplating building a barn in which to feed cattle. A neighbor of mine fed two car-loads in a barn last winter, and his experience was satisfactory. I believe that the time will come when the cattle-feeders of Illinois will adopt Eastern methods, and house all their stock.

“I will close by giving you the figures on two lots of cattle that I have fed. The first was a lot of sixteen choice three-year-olds that averaged, when I began feeding, January 23, 1880, 1,124 pounds. I was nearly a month getting them on full feed, after which I gave them all they would eat, feeding shock corn once a day and ear corn once. They averaged, April 29th, 1,358 pounds, having made a gain of 2 3-7 pounds per day each. At this date I turned to pasture and fed one peck of corn per day to each. This was fed in large troughs. I sold August 18th, when their average weight was 1,609 pounds, their gain on grass being 2½ pounds per day. I paid for these cattle \$35 per head, or \$560. I fed 981 bushels of corn, worth 25 cents per bushel, which makes \$245.25. They were grazed three and two-third months, at \$1 per month, making \$60. The customary price for pasturing is \$1.25 per month, but when corn is fed the price is less. These cattle brought \$1,105.06, a fraction over \$69 per head. I estimate that the increased value of the hogs following these cattle more than paid for the labor of feeding and caring for them.

“My second experiment in feeding cattle was in 1881, when I fed 34 head, three-year-old past. Commencing September 18th, I

kept them on grass for two weeks before giving corn, and then fed one peck of corn each per day till November 10th, when they were put in a one-acre lot, and fed in troughs all they would eat. These cattle made a gain of $2\frac{1}{2}$ pounds a day while on full feed, and gave a profit of \$630.89, or nearly \$20 per head after allowing market price for corn and grass. To have good success in feeding cattle, there should always be an abundant supply of pure water. With good cattle to start with, good care, and the cattle made fat before selling, the farmer is likely to be rewarded for his labor."

CHAPTER X.

CATTLE—SOILING AND ENSILAGE.

WHAT Is Soiling?—By soiling is meant the feeding of green food to farm stock in the stable or barn-yard during the grazing season, instead of allowing them to gather their own food from the pastures. In some countries of Europe the system has been generally adopted, and some experiments have been made in this country which have shown that it is practicable here as elsewhere. At present it would not, perhaps, be wise or economical for a majority of our farmers to adopt this plan, but doubtless there are many who would find great profit from it. I wish to present the subject fairly and impartially, showing not only the advantages claimed by the advocates of the system, but also the disadvantages which are connected with it. I have little doubt of its utility, and that in time it will be generally adopted as our lands increase in value and we become better farmers, and learn to appreciate the value of manure and the profit of heavy crops.

Our system of farming has been wasteful and improvident, as a consequence of cheap lands and the boundless "Out West," to which the farmer could emigrate after he had used up the available plant-food on two or three farms. Hitherto the question in farming has been too generally, How can we get the greatest profit from the soil with the least labor? and but little thought has been given to restoring the fertility removed. I believe that soiling could be now adopted with profit on lands worth fifty dollars or more per acre, and especially on small, fertile farms, and would result in such saving of expense and increase of profit and productiveness of soil as to far overbalance the objections to the system. The advantages claimed by the advocates of soiling are many.

Saving of Land.—It is claimed that the same amount of land required to pasture one animal will produce food enough for three or more if the food is cut and taken to them. This would not, perhaps, be true if grass only was depended upon for food, but even with this the difference would be largely in favor of soiling, as much of the grass is injured by the tramping of the stock, by their lying down on it, and soiling it by their droppings, liquid and solid, and the heavier the growth the greater will be the waste.

Under the soiling system the farmer does not depend on grass alone, but can grow other succulent crops, and often two or more on the same land in a season. Mr. Peer, in his book on soiling, illustrates the saving of land by increasing the amount of stock it will carry, and the increased productiveness which the manure from the stock will give, thus: "As in a crowded city they add to the capacity of their houses and factories by building up story above story, so the farmers of the older countries have been obliged to *build up their soil*, till they have farms two, three, or four stories high; that is to say, they have increased the productiveness of the soil until one acre is made to produce what formerly required three or four."

I here give the testimony, on this point, of farmers who have practiced soiling.

Hon. Josiah Quincy, who was the first advocate of soiling in this country, wrote on this subject in 1820: "My experiment has resulted in relation to the amount of land required in this: I have kept the same amount of stock by soiling on seventeen acres of land which had always previously required fifty." Over twenty-five years later he retired from public life and again took charge of his farm, and began again the system of soiling, and followed it for ten years, and in 1857, after an experience in all of eighteen years, he wrote: "Since 1847 I have kept from thirty to thirty-five head of milch cows in this way, and have realized every one of the advantages claimed for the system by European writers." As to saving of land, one acre soiled will produce as much as *three* acres pastured. Some European writers assert the benefit is equal to *one* to *seven*—this

great difference arising from the mode in which the land is enriched and cultivated for succulent products. Mr. H. Stewart, in an article in *The Country Gentleman*, says: "J. D. Powell, of Westchester County, keeps one hundred cows on one hundred acres;" and adds, "I have kept fourteen cows on eleven acres the year round by feeding brewer's grains and bran and meal."

Mr. Peer, says: "I kept for two seasons on thirty acres of land, the equivalent of thirty-six head of one thousand pounds each. This stock consisted of 13 cows, 5 yearlings, 4 calves, 4 horses, 2 colts, and 70 long-wool sheep, a total of 98 head." Mr. Peer's farm consists of one hundred acres of arable land, and before he began soiling he kept but twelve head of stock (one thousand pounds each), and cultivated forty acres. Under his present system he cultivates seventy acres. An experiment of Mr. Peer in 1880, contrasts the two systems: Twelve head of cattle were pastured four weeks on four and a half acres, and ate it so short as to shrink greatly in their milk; they were then soiled four months from four acres. In all Mr. Peer's summer feeding no grain was used.

Mr. Elliot W. Stewart, in his work on "Feeding Animals," says: "A full crop of red-clover will weigh, green, twenty thousand pounds to the acre. This fed in its green state, will keep twenty cows ten days, or one cow two hundred days, and would furnish in the second and third cuttings two-thirds as much more, or, in all, food for one cow a year. We have raised clover that weighed twenty-four thousand pounds per acre at a single cutting." Again he says: "A neighbor of mine measured accurately one acre of field-corn—grain in the milk—and fed to one hundred and four cows, and it gave full feed for four days, or feed for one cow four hundred and sixteen days. These cows were in milk, and yielded liberally on this ration."

Saving of Fences.—The plan of fencing our farms into fields, which is done only that we may be able to allow our stock to gather their food from them, imposes one of the heaviest burdens on the agriculture of our country. The adoption of the soiling system by the individual would at once relieve the

farmer of the expense of inside fences, and if generally adopted, the division fences between farms could also be abolished. The expense of a fence is not its only objection, for there is a loss of land, which with a hedge or rail-fence is about an acre to each half mile ; the loss of time in turning in small fields, the labor in cleaning out brush and briars from fence rows, and the seeding of fields with weeds allowed to ripen on them. In several of our States there have been men appointed to study and gather statistics in regard to the cost of fences, and repairs of the same, and they agree in their estimates, that under the grazing system it will cost an average of one dollar per acre annually to keep up the fences.

Extermination of Weeds is another advantage claimed for the system. On many farms the pastures abound with noxious weeds which the cattle do not eat, and they stand and ripen seed, and so keep up a succession. Under a system of soiling, the crops would be cut early and usually before the seeds of weeds had matured, and even if ripened and allowed to go into the manure, the composting of it would kill them. In soiling we should also follow a rotation that would bring our land under the plow so often as to kill out the weeds.

Saving of Food.—This has already been referred to in speaking of the food fouled and destroyed by the stock in various ways. In soiling, each animal can be fed just what it will eat clean, and can not get access to any more. It is a fact well established, that all force expended by the animal is at the expense of food, which acts in the animal system much as fuel does under the steam boiler, and the animal that must spend a larger part of the day foraging will require more food than if allowed to eat it without this labor.

Saving of Manure.—All good farmers agree in placing a high value on manure. It is the sheet-anchor of agriculture. By an abundant supply of it our crops can be doubled, and the risk of failure from nearly all sources greatly lessened. Under the pasturage system much of the manure is wasted. Some of it is dropped among rocks or in water courses. It is exposed to the sun and partly evaporated, and the residue dried into a

hard cake, which lies for a year or more on the land, killing out the vegetation under it, and adding but little to the soil. Much of it is washed away by the rains. In soiling we have absolute control of the manure, and can apply it to the crops which most need it and are in the best condition for immediate results. Mr. Quincy found that each cow made a load of manure per month, which he valued at \$1.50, and estimated that it would pay all the expense of the extra labor of soiling; and Mr. Stewart, in his book on "Feeding Animals," says: "From personal experience of more than twenty years, I regard the saving of manure in soiling as worth at least \$6.00 per cow, over that of pasture, and fully agree with Mr. Quincy, that it is a full compensation for all the labor, direct and indirect, of soiling."

Greater Production of Milk.—It is the testimony of those who have practiced soiling, that they get a larger amount of milk when the cows are fed in the stable than when allowed to pasture, particularly through the heat of summer, when the flies are troublesome.

A test, extending over several years, was made by Dr. Rhode, of Eidena Royal Academy of Agriculture of Prussia. "From forty to seventy cows were kept and pastured for seven years, and a separate account kept with each cow. The lowest average during the years of pasturage was 1,385 quarts per cow, in 1855, when seventy cows were kept, and 1,941 quarts in 1859, when forty cows were kept; and the greatest quantity given by one cow, in a year, was 2,988 quarts. The average per cow, for pasturing for the whole seven years, was 1,583 quarts. During the seven years of soiling, which began in 1860, from twenty-nine to thirty-eight cows were kept, and the lowest average per cow was, in 1862, 2,930 quarts, and the highest in 1866, when it reached 4,000 quarts. The largest quantity given by one cow in a year was 5,110 quarts, and the average per cow for the entire seven years of soiling was 3,442 quarts."

I give the above for what it is worth, for it lacks the data to enable us to tell how much of the increase is due to the soiling, and how much to the fact that fewer cows were kept and

better care given; but it is at least interesting to know that the average yield of the cows was doubled when they were kept in the stable; and whatever the amount of food, it is to be presumed there was a greater profit from one cow yielding 3,442 quarts of milk than from two yielding 3,166 quarts. Mr. Peer says: "With the exception of May and June, I have never failed to get better results from soiling than from pasturing."

In the *American Agriculturist*, Mr. Waring, in an article on soiling, says: "The product of the cows will be more in soiling than in pasturing. In June I was making a very satisfactory amount of butter (so were the pasture men all around); now, that drought has begun to affect the pastures, their product is falling off. My product is increasing, and is now ten per cent more than in June."

The above was written during the latter part of summer. There is another point in favor of soiling, which is that a better quality of milk and butter can often be produced, as neither short nor weedy pastures will make the best quality of butter.

My own experience in soiling extends over two years, and is perhaps hardly worth quoting in support of the system, as I fed some bran or meal every day in connection with the green food; but I never had cows more contented, or give a more satisfactory yield, both as regards quantity and quality. I began soiling in July, on account of a breechy cow having led the herd into mischief, a neighbor having a poor fence to protect his corn-field adjoining the pasture. At the time we began we were making a very unsatisfactory article of butter—soft and oily, and of poor flavor—as it was a time of drought and poor pasture. By the time our cows had been stabled a week, the butter was sweet and solid.

Objections to Soiling.—The first objection usually urged against soiling, is the labor of cutting and handling the large weight of food necessary for the cattle, especially in wet weather, when the fields are in bad condition for the teams, and when, as is sometimes the case, for days together the green crops would not dry. This objection is well worth considering; but

to offset this, the advocates of the system say that no man can make more than a living, in any business, by his own labor, and the men who make the most are those who best understand how to wisely employ the labor of others.

The cost of soiling may be considered under two heads—direct and indirect. By the first is meant the labor of cutting and taking to the animals the food consumed. This will vary under different circumstances—the number of cattle to be fed, distance that food must be drawn, etc. A small number will cost more per head than a larger number.

Mr. Peer, who has soiled for several years, says: "There is no excuse for its costing over two cents per day for each head." Mr. H. Stewart says: "Soiling is a little more laborious than pasturing, but each dollar spent in extra labor is replaced ten times over by the saving of feed, land, and manure. I have found labor very much cheaper than feed." Again he says: "All the feeding, cleaning, and attendance of twenty-six head of stock, viz: fifteen cows, seven heifers, one bull, and three horses, was done by a boy fourteen years old, and he had considerable time to spend in the field." Mr. E. W. Stewart, in "Feeding Animals," gives his own experience with thirty-five head, averaging 1,000 pounds each. They were fed from May 20th to December 1st. An accurate account of the labor was kept, and it required six hours per day of one man and two hours of one horse. The grass was cut with a light mowing-machine, hitched behind a one-horse cart, and two cart-loads were fed per day. One hundred loads of manure was made, which was regarded as full compensation for all the labor.

Where soiling crops, such as rye, oats, fodder, corn, etc., are grown, there will be some extra labor in preparing and seeding the land, but this will be repaid by the increased quantity of food grown. The difficulty of providing against wet weather is serious in bad seasons, but in many cases a storm can be anticipated and an extra supply of food secured, and occasionally the stock must be fed for a day or two on dry food and a little bran or meal added to the hay ration.

Another objection is the difficulty of providing a succession

of green crops that will last through the season and furnish a palatable ration at all times. This will be considered under the head of Soiling Crops.

Keeping the cattle clean on food that would cause a large amount of voidings—especially cows that are to be milked—would seem to be a difficult matter. I believe, however, that with a properly constructed stable there would be little difficulty; but the floor must be of just the right length so that the manure-ditch will receive the droppings. Mr. Peer says: "I have had a solid white cow in my stable for three years, summer and winter, and never remember seeing a manure-stain on her flanks, legs, or udder, and the same is true of all my cows."

Who Should Soil?—It is rarely wise for a farmer to make a sudden and radical change in the management of his farm, and I would not by any means advise the immediate general adoption of this system. There can be no question as to the wisdom of its adoption by the farmer of small means and a few acres, for it would enable him to largely increase his profits and improve the condition of his soil. The few acres of land which, under the common plan of management, would employ less than half a man's time, would keep him profitably at work during the entire summer if a few cows were soiled. Most farmers should feel their way into it. Let them first grow some extra crops, to be fed in order that the pastures may carry more stock, or that they may be able to provide extra food in case of drought.

I think that on all farms where there is some land unsuited for cultivation it would be found more profitable to adopt a system of partial soiling. The month of May and the first half of June is the grand pasture season, and stock of all kinds will do better on pasture at this season than anywhere else; but with the advent of summer heat and flies, every dairyman knows how difficult it is to keep up the flow of milk, or to keep stock gaining. By keeping one field on the farm in permanent pasture seeded with the grasses which start early in spring, the stock could be allowed to graze for six weeks—or two months in an early season—and the period of soiling considerably shortened.

Then the pasture could be used a day occasionally when there was a press of work or bad weather made it difficult to handle green food. This would relieve soiling of some of its greatest objections, for the most difficult time to get an abundant supply of green food for soiling is early in the spring, and that is when the stock needs it most, after many months on dry food; and the only really disagreeable work connected with it would be the necessity of cutting and handling the food in the rain. This plan would enable the farmer to turn his stock to pasture very early, for the pastures would be left well protected in the fall. They could also be stocked very heavily during this season of rapid growth, for if eaten close there would be plenty of time for the grass to make a new growth. In adopting this plan I think it would be best that the stock be kept up after soiling began, unless long-continued bad weather made it necessary to turn them out for a day or two.

In beginning soiling there are three points which must receive attention: First, enough food must be grown to provide against extraordinary drought, failure, or deficiency of crop from any cause; second, a succession of food must be provided for the entire season with as much variety as possible, and the more convenient to the stable the better; third, suitable preparation should be made for taking care of the stock and manure and for handling the food, with a view to economy of labor and comfort and cleanliness of the stock.

It is wise to begin with a larger acreage of crops in proportion to the stock kept than is generally recommended, for all surplus of the different soiling crops can be cured and kept for winter use, and it is always better to have a surplus than to run short. The farmer should also keep on hand a stock of hay or other food sufficient for a month or six weeks, so as to be sure the stock would not suffer in case of the failure of a crop. A little dry food will often be found beneficial also when feeding green succulent crops, as for example when you change from well-matured grass and clover to green corn. The succession of succulent food I shall treat under the head of Soiling Crops.

The stable and all the arrangements for the care of stock is a matter of greater importance in soiling than in winter feeding, for cattle will eat three or four times as great a weight of food and produce a greater weight of manure to be handled, and the arrangements should be as convenient as possible for handling both food and manure. The barn should, if possible, be so arranged that the wagon could be driven in with the food and it fed directly to the stock without extra handling, and this can be best secured by having the stables on two or three sides of a floor or drive-way raised above the level of the stable, enough so that all the cattle can eat directly from the floor. With a floor fourteen feet wide and a stable on each side, the loaded wagon can be driven in the center and the feed pitched directly to the stock on either side. The floor and manure ditch in the stable should be arranged as described in the dairy chapter, and there should be a good plank track for the wheel-barrow to the dumping place for the manure. If a large number of cattle are kept, it will pay to arrange the stable with a drive-way so that the wagon can pass through and the manure be taken directly from the manure ditches to the fields.

The nearer the crops used for soiling can be grown to the stable the better; and if all fences are removed, so that there will be no opening and shutting of gates, much time will be saved.

Soiling Crops.—The earliest crop from which we can cut green food is winter rye. It should be sown early for this purpose—from the first to the fifteenth of September in the Eastern and Middle States. I would recommend not less than two bushels of seed per acre. If it grows so vigorously in fall as to be in danger of smothering, it can be pastured when the land is dry, or cut high with a machine. It will do to begin feeding before it is in head, and when cut thus early will furnish a second crop. I do not find it a perfect ration, and think it best always to give some more nitrogenous food, such as bran, with it. It comes so early that it is of great value. On good soil from twelve to fifteen tons per acre can be cut, and about three-quarters of a square rod will feed a cow a day. If clover-hay

can be fed in connection with rye it makes an excellent ration, as one supplements the other.

Red clover alone, or mixed with orchard grass, will succeed rye, and of these crops you should provide one square rod per day for each full-grown animal. The amount of land required will vary with its quality.

Oats will be ready to feed before the clover has become too ripe, and it is well to give two or more kinds of food at the same time when the maturing of the crops will allow it. It will pay to begin feeding the oats before the heads show, as when cut this early they will give a good second crop. Three bushels of seed to the acre is recommended to be sown for soiling.

Perhaps no crop grown on the farm responds so generously to fine tilth and thorough preparation of the soil as oats, and the crop will not only be much heavier, but also several days earlier if great pains is taken. In the more northern latitudes peas may be sown with the oats, and will furnish a large amount of excellent food. It may be cut from the time the peas are in bloom till they are grown to full size in the pod.

Before the crops named are exhausted, timothy will be ready to cut. For soiling I would always sow with it the large clover or the alsike, as both of these clovers bloom late, and continue in bloom for some weeks, and the food will be better and more abundant from the mixture than from either alone.

This will bring us to the great staple crop for green feeding, fodder-corn. No other crop will furnish so great an amount of food, half a square rod on good land producing enough to feed a cow a day. Our Western field varieties will produce the heaviest crop, but Stowell Evergreen is of better quality, and as it will form ears when quite thickly planted, and remain for a long time in a succulent state, I think it the best variety for this purpose. I do not recommend broad-casting or very thick drilling, but would make the rows three and a half feet wide, and would give thorough cultivation. I believe two or three stalks to the foot will give the best results.

To give variety, millet and hungarian grass and sorghum

may be grown to feed with the corn. The millets grow rapidly and yield abundantly, but the ground must be well prepared, or the young plant will not make a thrifty start, and will be likely to become choked with weeds. Sorghum, when grown for soiling, should be drilled very thick to prevent the stalks from becoming too hard.

In all soiling it will be found profitable to provide as great a variety of food as possible, and by a little care one can usually have two or more kinds on hand at once. When this is done, cows can be kept up to a full flow of milk, or the stock be made to gain in flesh on the green crops alone; but when such food as immature corn-fodder is fed, it will be found profitable to give a few quarts of bran, or a pound or two of linseed or cotton-seed-meal daily, to each animal, as it will pay in the improved condition of the stock and the increased value of the manure.

It is best to feed frequently and a small quantity at a time; for if a large quantity of food is given at once, much will be wasted, as an animal will, though hungry, reject food which it has breathed upon and nosed over. If any food remains before the cattle after they have done eating, it is better to throw it out in the barn-yard or to the hogs. The stock should be fed five times a day, and the food for the two morning feeds, five and eight o'clock, should be brought in the night before, as it is not best to cut when the dew is on. They should be fed again at noon, at four o'clock, and at seven. One will soon learn how much to give, which should always be only what they will eat clean.

Double-cropping in Soiling.—One great advantage of the soiling system is, that it enables the farmer to grow two crops in a season on much of his land, and furnishes so much manure that this can be done without injury to the soil. The land on which the rye is grown can be planted in sweet-corn, and the same is true of the clover. Millet may be sown after either of these crops, or it or corn after the oats. Where beets are grown, as I recommend in the chapter on hogs, alternate rows can first be fed, and corn drilled, and the remaining rows of beets fed out before the corn is large enough to need the

land. If the soil is rich and in good condition, the planting season may continue till August. It is better to keep the land cultivated than to allow it to become seeded with weeds, even if only a light crop is grown, but in favorable autumns a heavy crop of fodder-corn can be grown from as late seeding as this.

Silos and Ensilage.—The above terms have lately become familiar to all readers of agricultural papers, but in our own country few farmers ever saw a silo, and many have no definite idea of what ensilage is. A silo is a pit, cistern, or bin, in which green food can be preserved for feeding farm-stock through the winter, and ensilage is the name given to the food thus preserved, without regard to what crop it is made from.

Practically it is the same system as that by which we preserve fruit by canning, the silo being a huge can, but as it can not be so perfectly sealed as a fruit-can, there is always a slight degree of fermentation in the food, which has led some farmers to give to ensilage the name of "cow-kroust." The first thing which led to the discovery of the system of ensilage was attempts to preserve the beet-pulp at the sugar factories in France; it was pitted as we bury potatoes, and kept for months in this way. It was found that all that was necessary was an economical plan to exclude the air. After it had been demonstrated that beet-pulp could be kept in this way, a trial was made with green corn. Trenches five feet deep were dug in dry earth and filled with green corn-stalks, packed in flat and carried up a few feet above the surface; this was covered with straw and weighted down with earth, and as it settled, more earth was added to exclude the air. It was found that fodder could be preserved in this way so that cattle would eat it readily, but there was more fermentation than desirable. This mode of preserving fodder was practiced for many years in Germany and France.

Experience soon showed that the closer the fodder was packed the better it would keep, and the next step was to run it through a cutting box, cutting it into lengths of half an inch or less. It was found that it could be thus packed more closely, requiring less space, and keeping better. Finally a Frenchman

built a pit with air-tight walls, ten or twelve feet deep, and stored the cut fodder in it, covered it with boards, and weighted it down with five hundred pounds to the square yard. He found, that by this means the fodder was preserved in good condition throughout.

The fact that fodder-corn can be preserved in this way has been fully established, and also that these green crops, cut at the point in their growth when they are most succulent and nutritious, will retain all their feeding value, and not only be palatable to the stock, but also have a good effect upon the health and growth of the animal.

It has perhaps been unfortunate for the system that those among the first to experiment on it in our country allowed their enthusiasm to run away with their judgment, and put forth absurd claims which led farmers to look with suspicion upon the process. The first silos built were also generally expensive, and the impression made upon farmers was, that they must be built of concrete or solid masonry and made below ground. It has been found, however, that a very cheap silo can be made that will preserve the crops as well as the more expensive ones. How to make a cheap silo will be described in this chapter.

There are now enough silos in the United States, and in the hands of such men that a few years will put us in possession of facts which will enable us to definitely settle the question of profit connected with this method of feeding. With such men as Professor Henry, of the State University of Wisconsin, and Professor Roberts, of Cornell University, of New York, and others, who are experimenting, not for the purpose of establishing some pet theory, but to ascertain the relative merits of dried fodder and ensilage, we may be sure of an impartial and practical treatment of the subject.

Conceding that the question is already settled that green fodder can be preserved in a silo, and that stock will eat it and thrive on it, there are still several questions to be considered before farmers should adopt the system.

Among these questions are: 1st, Cost of a silo; 2d, Comparative cost and risk of damage in curing fodder, or in

ensilaging it; 3d, Comparative value for food of dry fodder and ensilage; 4th, Relative labor of feeding by the two systems.

The cost of a stone or concrete silo is estimated at about \$1.25 for each ton of capacity. A cubic foot of ensilage will weigh about forty-five pounds, and about twelve tons can be stored in the space which one ton of hay would occupy. In building a silo, you will need to provide about two cubic feet of space per day for each animal of one thousand pounds weight, if they are to be fed all they will eat. In Professor Henry's experiment, two cows, weighing two thousand six hundred pounds, ate an average of one hundred and five pounds per day for twenty-one days, and two cows, weighing two thousand pounds, ate an average of ninety pounds each per day. These cows were giving milk, and were each fed, in addition to the ensilage, two pounds of bran, two pounds of corn-meal, and three pounds of oil-meal per day. Mr. Peer estimates that if cattle are to be kept for six months on ensilage without hay or other coarse fodder, that five hundred cubic feet should be allowed for each head.

How to Make a Silo.—If the farmer decides to follow the system of ensilage feeding, it will pay him to build a permanent silo; but for the purpose of experimenting, a cheap one may be made. A silo like an ice-house can be made of any material that will exclude the air, and a bay in the barn, boarded up so as to allow a four-inch space to pack with earth, will answer; but in case a space in the barn is used for this purpose, one must remember the great weight, and not run the risk of losing the crop by breaking down the floor. It would probably be better to take out the floor and lay down loose boards on the earth, so that all the weight would rest on the ground. In this case it would be necessary to make the double wall the width of the sills, as there must be no projection to impede the settling of the ensilage. For the same reason the inside of the silo must be made smooth, so that the plank covering may fit closely and settle without hindrance, and for the same reason it should be boarded up and down.

Several points must be considered in building the silo. It

should be easy of access, so that it can be filled with a minimum of labor; convenient to the stable, so as to avoid unnecessary labor in feeding. If partly or wholly below ground, it must be so arranged that no water can enter it. There should be but one door to the silo, and this should be at the point most convenient to the stable, and it must be closed and made double and packed like the other walls, until the ensilage has settled and is fit for use. This door may be on a level with the bottom of the silo, as in feeding there is no necessity of taking out the ensilage from the top, but it can be cut down in sections from the top to the bottom as it is needed for feeding, and when ready for use, it will be packed so closely that no air can penetrate it, and a double door will not be necessary. It is advisable, for several reasons, that the silo, if large, should be partitioned off into smaller ones. The advantages are: 1st, A small silo can be filled more rapidly and sealed sooner than a large one, and, when uncovered, less ensilage is exposed; 2d, With several small silos, one can put in a crop at any time through the summer; 3d, If a drought occurs during the summer, and the stock need it, a small silo can be fed out, when it would not be economical to open a large one.

To show how cheaply an experimental silo can be made, I give a description of one which can be easily understood. In the report for 1882 of the experiments at the university farm, at Madison, Wisconsin, Professor Henry describes his silo, constructed for experiment, as follows:

“About the buildings of the experimental farm the land is comparatively level, but in one place not far from the barns, there is an embankment about seven feet in height. An excavation was made in the face of this embankment, extending back fifteen feet and having a width of twelve feet. The bottom of the excavation was on a level with the ground at the foot of the embankment. About the sides of this excavation two by four scantlings, ten feet in length, were placed upright as studding (narrow-ways) against the earth wall, and also at the open front. Upon the inside of these, studding boards were nailed. These boards were carried up to the top of the stud-

ding, so that it gave a room twelve by fifteen feet, and ten feet high. This box, as will be understood from the previous explanation, stood about seven feet in the ground on two sides, but had an exposed front. Where it extended above the ground and at the front, boards were nailed upon the outside of the studding also. The four-inch space thus formed was filled with earth so as to exclude air. Studding were then placed on end lengthwise through the middle of this box, and boards nailed to both sides of these and earth placed in the four-inch space as before. This gave two small silos, each about fifteen feet long, nearly six feet wide, and ten feet deep. In putting the boards on no care was taken to make them fit closely, and they were full of cracks and nail-holes, as old lumber was used, but as most of the silo was below ground, and that part which extended above had a four-inch space filled with earth there was little chance for the passage of air. Such a silo is far from having air-tight walls, in the true sense of the word. This silo had only the natural earth floor. The roof was made of old boards well lapped to keep out the rain. The labor required for excavation was one team, ten hours; farm hands, thirty-four hours. For building the silo, farm hands, fifty hours. Allowing fifteen cents per hour for team and hands, the cost of the silo for labor was fourteen dollars and ten cents. About two thousand feet of old lumber was used in its construction.

Filling the Silo.—The green fodder used for filling the silo must be cut fine, the object being to insure compact storing and consequent exclusion of air. About three-eighths of an inch is recommended as the best length to cut.

It should be placed at once in the silo and thoroughly packed. Where the size and location of the silo will admit of it a horse or mule can be used to tramp it. The usual custom is to have one or two men to tramp it, according to the size of the silo and the amount of ensilage cut each day, and if provided with light rammers they will do better work and easier than to tramp all the time.

It is not necessary that the silo should be filled in a single day, but the filling should be as near continuous as possible, not

less than two feet in depth being put in each day. When filled very rapidly the ensilage will settle more, but if there is too much delay, an injurious amount of fermentation is likely to ensue.

When the silo is full, it must be covered immediately with boards, and weighted down with from five hundred to nine hundred pounds to the square yard. If stone can be had conveniently they will furnish cheap material for this purpose, but boxes filled with earth will do as well. The ensilage will settle considerably, even when well-packed during filling, and where the silo is located so that it can be done, it is well to set a temporary frame round it so as to fill a few feet above the top, as it will soon settle down into the silo. It is well to spread a foot of straw over the top before putting on the boards.

The cover must be put on so that nothing will interfere with its settling, and the weights should be put on so as to admit of a part of the cover being removed without disturbing the rest. The ensilage will begin to heat, but if properly covered the heat will pass off.

Cost of Ensilage.—The cost of growing rye, clover, corn-fodder, or other crops for ensilage the farmer can readily estimate for himself, but I have some data as to the cost of cutting and filling the silo. The first year that Professor Henry put up ensilage the amount was but about ten tons, and the cost of cutting and storing was one dollar and sixty cents per ton. The next year, with over thirty tons and better facilities for handling, the cost was eighty-nine cents per ton. Dr. Tanner, of Orange County, New York, estimates that with a large quantity it can be cut and put in silo for seventy-five cents per ton, and Mr. Chaffee, of the same county, estimates the cost of raising and putting in the silo at two dollars per ton. All of these estimates are where corn is used as the ensilage crop, which in my judgment can be handled cheaper than any other used for this purpose.

Crops for Ensilage.—Any green succulent crop can be stored in this way, but from all I can learn on the subject, corn

is the crop which furnishes the greatest bulk of food, and the one most to be relied on for ensilage. It is my judgment that the best feeding results will be found by the use of ensilage in connection with other food, and that it will be best to cure for hay the grasses that are easily preserved in this way, and ensilage the succulent clover and corn, which are difficult to cure. Most extravagant and absurd statements have been made as to the yield of fodder corn per acre. Dr. Baily says and repeats it in his "Book of Ensilage:" "I do not think it will be at all difficult to raise forty to seventy-five tons per acre on good corn land."

Such statements are misleading, and from my own experience I estimate that on good corn land, without manure, we could not average above twelve tons, and I have found that on a rich manured soil it takes a heavy growth to produce twenty tons.

Clover on good land may make ten to twelve tons at the first cutting, and in favorable seasons the two subsequent cuttings sometimes make eight tons, but this will not be reached under ordinary culture. Millet on good land will make eight to ten tons per acre. Oats, or oats and peas mixed, will be found a valuable crop for this purpose, and will give a heavy yield. Sorghum will doubtless prove an excellent crop for ensilage, and will produce as heavy a crop as corn, and if cut early, it will produce a second crop. Winter rye will produce from twelve to sixteen tons to the acre, and ought to average ten tons.

All crops for ensilage should be cut somewhat greener than if to be cured. Clover should be cut in full bloom. Millet and oats, as soon as the blossom falls; corn should be past the blossoming and approaching the milky stage. Sorghum should be cut before heading, as the stalk has too hard a sheath when approaching maturity, and by early cutting a second crop will be produced. Rye should be cut as soon as the heads begin to show, as the straw becomes hard very soon after heading. In a recent conversation with Professor Roberts, of Cornell University, he told me that he lost a silo of ensilaged rye from allowing it to become too mature; the straws were too hard to yield to pressure,

and many of them remained whole—little tubes filled with air—and spoiled the ensilage.

We can take no food value out of the silo that we do not put in, and it must be remembered that corn-fodder is not a complete ration, particularly if it has been grown thick on the ground and cut when immature. The best results from ensilage will probably be when it is used as a substitute for roots, and fed in connection with grain and some hay. Perhaps common field-corn planted and cultivated so as to produce ears and ensilaged when in the roasting-ear stage, would be one of the best crops for ensilage. It would yield a very heavy weight to the acre, and would be more nearly a complete ration than if planted thick and cut green.

Experiments With Ensilage.—The cheap silo built by Professor Henry, which I have described, was filled on September 4th and 5th, from a plot of corn grown for the purpose of testing the relative value of ensilage and corn-fodder. Eighteen rows, three feet apart, forty-eight rods long, were planted with common yellow corn, and eight rows, fifty rods long, with ensilage corn, making in all about one and a quarter acres. Half of this corn was put in the silo, and at the same time the other half was cut and shocked. The weight of the ensilage was twenty-one thousand two hundred and twenty pounds as put in the silo. On the 25th of October, when the corn-fodder was in good condition, it was bound in bundles and put under cover. It weighed six thousand six hundred and forty-three pounds. The ensilage when first put in filled the silo to the top, but had settled nearly one-half when feeding was begun, the 16th of November. At this date four cows were selected that had been giving milk for nearly the same length of time, and two of them were fed for twenty-one days on ensilage all they would eat, and the other two on the fodder. Then the food was changed, and the two that had eaten fodder were fed ensilage, and *vice versa*, and after preliminary feeding for a week, another trial of twenty-one days was had. These cows were each fed two pounds of bran, two pounds of corn-meal, and three pounds of oil-meal per day, during the trial.

The result of these two trials showed that thirteen rows of ensilaged corn lasted two cows seventy days. Thirteen other rows, equal in all respects when cut, shocked, bound, and housed, lasted two cows forty-seven days. In length of time it fed the cows, the value of the ensilage exceeded that of the corn-fodder by nearly fifty per cent.

The following table shows the milk and butter product of forty-two days ration of fodder and ensilage for two cows:

Milk from fodder-corn,	1,322 lb. 15 oz.
Butter from fodder-corn,	53 lb. 5 oz.
Milk from ensilage,	1,456 lb. 8 oz.
Butter from ensilage,	59 lb. 8 oz.

From this it will be seen that the cows fed on ensilage produced one hundred and thirty-three pounds nine ounces more milk, and six pounds three ounces more butter than when fed on fodder-corn.

The corn-fodder when put under cover in October, weighed 6,643 pounds, but as fed out, only 4,615 pounds, showing a loss of about thirty per cent from drying in the mow. The loss in weight of the ensilage was about twenty-five per cent, 21,220 pounds being put in, and 15,963 pounds taken out of the silo. From three to six inches of the top of the silo, the ensilage weighing 2,183 pounds, was rotten and unfit for use. There was also 446 pounds of the fodder molded and thrown out.

The ensilage made from the large ensilage-corn was eaten clean by the cattle, while the fodder from this corn gave nearly fifty per cent of waste—2,393 pounds of it were fed, and 1,137 pounds weighed back. With the common yellow corn the waste was but about twenty-nine per cent—1,481 pounds being fed, and 431 pounds weighed back. The cows were weighed at the beginning and close of each trial, and the result was that in the first the cows fed on fodder gained ten pounds, and those fed on ensilage twenty-four pounds. In the second trial, those fed on fodder lost eighteen pounds, and those fed on ensilage lost thirty-nine pounds. All the details of this experiment were carried out with the utmost care. The milking was done with perfect regularity at half-past four, morning and

night. Every article of food was carefully weighed, and all rejected was weighed back. The water was also weighed, and the milk of each cow weighed separately, and recorded. The churning was done twice a week. It is a question whether the fodder or the ensilage was the more profitable, as, when the cost of building the silo and the extra cost of ensilaging the crop is taken into account, it might over-balance the advantage.

We have no estimate of the cost of securing the corn-fodder, but as its weight was less than one-third as much as the ensilage, and it was not run through the cutter, it is safe to say that would not exceed one-third the cost of the ensilage. Then the labor of feeding to each cow an average of nearly one hundred pounds of ensilage must have been considerably more than that of feeding the fodder, of which only thirty-five pounds per cow per day was fed.

From Professor Henry's report I also take the account of feeding hay and ensilage to calves. "Two calves were placed in one box-stall, and three in another. The food allowed each calf was two pounds of oil-meal, two of bran, and four of oats, per day, divided into two feeds. In addition to this, the two animals in the first lot received all the ensilage they could eat, while those in the second lot were fed blue-grass hay of medium quality. One calf in each lot was a full-blood Holstein, the others were full-blood Short-horns. All were born in May or June of the previous spring. They had been raised on skim-milk, and were in good condition. The weights of the several animals, on January 7th, were as follows:

Lot 1.	
Holstein heifer,	550
Short-horn bull,	522
Lot 2.	
Holstein heifer,	476
Short-horn bull,	474
Short-horn heifer,	448

"They were fed, carded, watered, and weighed regularly each day during the experiment, and in fine weather allowed exercise in the open air.

"The experiment began January 7, 1882, and continued to January 30th, when hay was substituted for ensilage with lot one, and lot two were fed ensilage in place of hay, the other part of the ration remaining the same. After this change the experiment continued twenty-two days longer. It will be seen that two ate ensilage while three were eating hay, in the first trial, and in the second, three were eating ensilage and two hay. The equivalent would be, five calves twenty-two days on ensilage, and five twenty-two days on hay. During the first trial of twenty-two days, lot one ate 995½ pounds of ensilage, and gained 74 pounds. The same time lot two ate 266 pounds of hay, and gained 92 pounds. During the second trial of twenty-two days, lot one ate 333 pounds of hay and gained 112 pounds. Lot two ate 1,355½ pounds of ensilage and gained 148 pounds.

"A summary of the two trials would give us the following:

1ST—ENSILAGE.

Total amount eaten in the two trials,	. . .	2,351 lbs.
Total gain in the two trials,	. . . . .	222 "
Pounds of ensilage to one of gain,	. . . . .	10 $\frac{5}{8}$ "

2D—HAY.

Total amount eaten in the two trials,	. . . . .	599 lbs.
Total gain in the two trials,	. . . . .	204 "
Pounds of hay eaten to one of gain,	. . . . .	2 $\frac{9}{16}$ "

"From this it appears that one pound of the hay was equal to three and six-tenths pounds of ensilage. The appearance of both lots of calves at the close of the experiment was excellent, and the impression gained, aside from the test of the scales, was very favorable to ensilage all the way through the experiment. That calves will eat it with avidity, and thrive, when properly fed, is beyond all question."

These experiments were conducted in all fairness, not to bolster up a theory, but to ascertain the value of ensilage. They seem to show conclusively that a given weight of green food ensilaged is worth more than the same amount dried, but do not show so great an increase in value as has been claimed by some advocates of the system. There are doubtless both advantages and disadvantages connected with it. Among the

former may be enumerated the increased value of food prepared in this way; the good effect on the health of the animal—if it is properly prepared—the ensilage being a substitute for roots; the fact that a crop of corn may be grown after clover or barley, and saved in this way late in the season when it would be difficult to cure it at all; and the economy in storage room. The disadvantages are the increased labor and extra expense of handling so great a weight of food, both in putting it in and taking it from the silo; the expense of making a silo; the disagreeable work of feeding ensilage in cold, freezing weather.

Further experiments will be necessary to settle the question as to whether it will be profitable to adopt the system or not, and in the mean time nothing will be gained by extravagant claims in its favor, or by denouncing it as a humbug. Several cases have come to my notice where the milk of cows fed on ensilage has been rejected at condensing factories or creameries, as it was found to contain acids which prevented its making a good article of condensed milk or butter.

CHAPTER XI.

CATTLE—THE DAIRY.

THE annual butter product of the United States has been estimated at about one thousand million pounds, and a committee appointed by the New York Butter and Cheese Exchange to investigate the matter, reported that the statistics were incomplete and defective, and that from the best data at their command they believed the annual product would reach fourteen hundred million pounds. Probably in no other country on the globe is the consumption of butter so great per capita as with us.

As co-operative or factory dairying will be treated under a separate head, I shall confine myself at present to farm dairying. Aside from providing for the wants of the family, under what circumstances will it pay to run a butter dairy?

I answer: First, only when there is sufficient help in the house to enable the work to be done at the right time and well done. A woman can not have the care of a family of children, do the cooking, mending, making, sweeping, and the thousand things that devolve on a mother, and be a good dairymaid, or if she is, it is more than one woman ought to do. Second, there will be no profit in butter-making unless a superior article is produced, and this can not be done without suitable apparatus and conveniences, and no one should attempt it unless these are provided.

In other words, in running a butter dairy there will be much hard work, which can not be postponed, as the cows must be milked, the milk put away, skimmed, and churned, the butter worked and prepared for market every day, and this must be done in the freezing weather of winter, and the hot, sultry days

of summer. Before deciding to engage in the business, one should take all these matters into consideration, for it is better to let the calves run with the cows than to have all this work for no profit.

To make a butter dairy profitable, not only must a superior article be produced, but it must be sold above the average market price. Fortunately, the consumption of butter increases as the quality improves, and the farmer who makes a first-class article is not likely to hunt long for a market.

Selecting the Cows.—It will be a work of time to get a herd of good butter cows, and my experience in buying leads me to advise that the cows be bought largely with reference to what they will bring for beef, so that if they prove unprofitable for dairy purposes, you can get your money back from the butcher. In looking back over my own experience, I see that I have rarely found it profitable to buy high-priced cows, and that many of the best I have ever owned were bought at a moderate price. There are many farmers who have excellent butter cows and do not know it. They do not feed well enough to make a cow profitable, and the milk of each cow is not tested separately to ascertain which gives the richest.

Buy young, thrifty cows; feed liberally, so that if they do not give rich milk, or enough of it, they will soon fatten, and then cull out all that are unprofitable. It will pay to raise the heifer calves from your best cows, and in time you can raise the standard of your herd, and largely increase the profits of the business. If a cow will pay for her keeping on a weekly product of four pounds of butter for a season of six months, one that will produce seven pounds will give a good profit. Mr. Williard, in his *Butter Book*, says: "The average annual product of good cows in herds of from fifteen to twenty-five animals, in good dairy districts, is about two hundred pounds. Occasionally an extra herd will produce two hundred and fifty to three hundred pounds per cow, while individual cows often yield a much larger product."

Testing the Cows.—As the quantity of milk required to make a pound of butter varies from eight to twenty quarts, it

will pay the dairyman to be at considerable pains to test his cows. The points of a desirable dairy cow are, that she should give a good quantity of milk, that it be of good quality, that she continue in milk for a long period, that she milk easy, and is of a quiet, gentle, disposition. In ascertaining the quantity of milk it is necessary to keep a record of the product of each cow, and the easiest way is to have a platform-scale in the stable, and weigh the milk. Then there should be a large sheet of paper and a pencil secured by a string, so as to put down at each milking the amount of milk from each cow. Such a record could be kept with very little trouble, and would furnish valuable data in determining the value of any particular cow. By a glance at it you could see which cows were shrinking most in their milk. If any change is made in quantity or quality of feed, the record would be of value in determining the effect of such change. The sheet of paper used for the records should have as many horizontal lines as there are cows, and perpendicular lines to last a month. The cows can be designated by number or by name. I would never record fractions of a pound, but if the fraction was less than eight ounces make no account of it, but if more than eight ounces call it a full pound. This would give a fair average, and make it easier to keep the record and strike the averages.

The next matter to test is the quality of the milk, and for this purpose a test or percentage glass will be needed. This is a glass tube, or cup, with a graduated scale marked on it, each mark representing one hundredth of its depth, or one per cent. The glass is nine inches deep and two in diameter, and has a broad, flat base like an ordinary goblet, so as to prevent its tipping over easily. In using it, fill carefully, so that there shall be no foam on the milk, and see that the milk comes exactly to the top mark of the scale. It should be allowed to stand thirty-six hours. The per cent of cream will often appear greater at the end of twelve or twenty-four hours than at the longer period, for the cream condenses somewhat by standing. One of



TEST GLASS.

these glasses should be kept in every dairy. They can be ordered through any druggist, as wholesale dealers in surgical supplies keep them.

The daily record of milk will show whether the cow holds out well in her milk, or begins soon to fail, and by adopting these tests one can soon determine the value of his cows, and decide which to keep and which to sell.

Breeds.—It is not my purpose to recommend any one breed of cattle above all others, for the farmer must judge for himself what will best suit his farm and circumstances. On a hilly farm the smaller breeds will be likely to give the best satisfaction, and as a rule they give the richest milk. The Jersey and Devon are noted for the quality of their product. There are some strains of Short-horns noted for their excellence for the dairy, but as a rule they are deficient in the points which make cows valuable for this purpose, as they come from a line of ancestry which has been bred for meat rather than milk or butter. A few Jersey cows in a herd, or an admixture of Jersey blood, will often be found profitable, as it will improve the quality of the butter. A single cross with the Jersey will not materially reduce the size or meat-producing qualities of the animals. It is doubtful if it is desirable, or would be found profitable, to attempt to secure a herd for dairy purposes of pure-bred animals. The best results will be attained by careful testing of all, and weeding out of those which do not come up to the standard, and the use of thorough-bred bulls selected from such a breed as possesses the points you wish to improve, and from a strain noted for its dairy qualities.

When butter is to be sold in the market with no contract as to price, I think a greater profit can be made from cows fresh in the fall. I have known small dairies managed in this way that gave good satisfaction. The price of butter from October to May is usually considerably higher than through the summer, and where one is so situated that calves can be had to put with the cows in the spring, they will often give a greater profit than to make butter through the hot weather, when flies are troublesome, and it is so difficult to make good butter. Good

butter can be made during the seven months, October to April inclusive, without ice, and the cows, although beginning to fail in their milk at the end of this period, will increase when they go on fresh pasture so as to give a calf a good start, if you wish to raise it, or make of it a good veal before they go dry.

Even if butter is to be made the entire year, I recommend that half the cows or more be bred for fall calves. It is much easier to have the cow in good condition in the fall than after a winter on dry feed, and the cow that comes in at this season will give quite a per cent more of milk in a year than one that is fresh in the spring, for at the time the latter naturally begins to fail in milk, the season of flies and short pasture comes, followed by the transition to dry feed, and it is very difficult to prevent a large falling off. On the other hand, the cow fresh in the fall goes on fresh pasture just at the time she begins to fail, and as a result, the flow of milk is largely increased.

The best authorities agree that it is better that a cow should be dry not less than six weeks, not only because her system requires rest, but the mixture of old and new milk is liable to cause garget. It is not best for the calf that the cow be milked continuously, for nature provides in the colostrum or first drawn milk after calving medicinal qualities to cleanse the young calf, and free its bowels from the matter always existing in them at birth, and if the cow is milked continuously the milk does not undergo this change.

If you have the necessary conveniences so that you can be sure of making first-class butter in all weather, and can get a yearly contract at a price that will pay, I would advise that butter be made the entire year, but if you must depend on the groceries for a market and come in competition with all sorts of butter, then the plan of fall and winter butter-making will save labor and be likely to give the greatest profit.

Gilt-edged Butter.—We have seen much in the agricultural papers during the last few years about "gilt-edged butter," and I have received many letters from farmers asking what it is and how made. It can scarcely be classed as a farm product, for, as I understand the term, to produce it requires such

careful selection of cows, such care in their feed, and nicety of manipulation of the milk, cream, and butter, that it becomes a fine art. It must be perfect in texture, grain, color, and fragrance, and is made up in small pats of one-fourth pound, each in a linen cloth, and delivered to the customer with the very odor of a clover-blossom.

Such butter as this sells for \$1.00 per pound in some of our city markets, and customers for it can only be found among the wealthy classes. It can only be made after serving an apprenticeship, and under a combination of circumstances so favorable that practically it is out of reach of the farmer. I am of the opinion that there would be a greater profit in first-class dairy butter at less than half the price, and this can by proper care be produced on any farm. What I mean by first-class dairy butter is, that it be sweet and free from all bad odors or flavors, of good color and grain, and free from butter-milk. A product of this kind can be made, and if we do not make it, the fault must be looked for in the feed, the stable, or milk-room. An artist who was chiseling at a block of marble, when asked what he was doing, replied, that there was a lamb shut up in it, and he was letting it out. So there is in the milk, drawn from cows that have been properly fed, sweet fragrant butter, but it can be spoiled by unskillful handling as surely as could the marble statue.

Pastures and Food.—All dairymen agree that a pasture of mixed grasses gives the best results for dairy stock. In seeding down permanent pastures for this purpose I would use timothy, orchard-grass, blue-grass, red-top, and white and red clover. A pasture-field sown with a number of varieties of grass will not only produce more food, but a better quality of milk and butter, than if but a single variety is used. In addition to this, if there is good shade and an abundant supply of pure water, we have all the elements of success so far as the production of milk is concerned. Williard in his *Butter Book*, says: "Different kinds of food have more or less influence on the flavor of milk. Some kinds are much more efficient than others, not only in promoting good flavor in the milk, but in maintaining health and thrift in the animal.

“For butter making it is essential that cows have an abundance of rich and nutritious food. Food should be abundant and easy of access, because much traveling or exercise in obtaining it checks the milk secretion, the food going to supply the waste of tissue lost in extra labor rather than for milk. I know of no better food for milk cows than rich old upland pastures, where there is a variety of grasses, and the herbage thick, sweet, and nutritious; where a cow can get her fill without much labor; where good, sweet water is convenient, and where there is shade, under which she can rest and ruminate. These, in my opinion, will be about the best conditions in which the animal can be placed for yielding much and very fine butter; and under these favorable circumstances I do not think any profit will be realized by giving grain or meal of any kind as a supplementary food.”

If the pastures are weedy or short so that the cows can not fill themselves readily, it will pay to give additional food, and I have found that a moderate feed of meal is of as much advantage to the quality as to the quantity.

The acreage to a cow varies so greatly on different soils and in different seasons that no rule can be laid down. Our best lands, when well set with a variety of grasses and clover, will in favorable seasons pasture a cow to the acre, but where no provision is made for drought and no extra food is given, it would not be prudent on most farms to stock so heavily, and two and a half acres to the cow would not be too much. It is a matter of interest to ascertain whether it would not often be cheaper to stock heavily, and feed meal and bran regularly through the summer, thus doubling the number of cows and often improving the quality of the product.

As we are liable to drought at some time during the pasture season, the dairyman should always grow some green crops, to be fed if necessary; and as the dry weather is more frequently late in the summer, and no other crop will yield so much food as corn with the same labor, I recommend this for the main crop. I think the planting of corn for late feeding should never be neglected, for no matter how favorable the autumn, the grass is

less nutritious than in spring and usually less abundant, and a feed of green corn will be of great benefit.

If the season proves good, so that the corn is not needed for green feeding, all the early plantings can be cured for winter feed. For late green feeding planting may be done any time in July, and if the land is rich, and cultivation frequent and thorough, a very large crop may be grown. This can stand out through quite heavy frosts without injury, and in the latitude of Southern Ohio we can usually feed it from the field till the middle of November, and often later.

Full Feeding Profitable.—I think there can be no doubt that more profit will be had and a better article obtained from full feeding, but I do not advocate heavy grain feeding. The feed should, however, be at all times abundant, sweet, and nutritious. It should also be varied and have the proper bulk. Sweet clover or June grass hay and well-cured corn-fodder I consider best for the bulky food, and bran and corn-meal for the condensed food. Every year of feeding adds to my appreciation of bran, and as a milk producer it is superior to corn-meal, but I think we get a better ration from the two mixed than from either alone. The best mixture is half and half by weight, which gives nearly two bulks of bran to one of corn-meal. As long as there is soft corn to feed in the fall or a supply of pumpkins, or when feeding beets or carrots, I would not care to grind the corn, but would feed whole, and think just as good results can be had as by grinding, and much trouble and expense saved. I can usually effect quite a saving by laying in a stock of bran soon after harvest. The demand is less at this season of the year and the mills are often over-stocked, and I have frequently bought at ten dollars per ton, when had I waited till winter it would have cost fourteen or fifteen dollars. Bran will keep perfectly sweet when stored in a large bulk, so there is no risk in buying a winter supply at this season of the year.

The Stable.—Where a considerable herd of cows is kept the milking at all seasons of the year should be done in the stable, for a fractious cow or one in heat will often make trouble with the entire herd. There will sometimes be wet weather

when the cows will be dripping, and you can not without great trouble tie up a lot of cows unless they are accustomed to it daily, and the flies will not be so troublesome in the stable as in a lot. This stable should be conveniently arranged with a manure ditch, and short partitions between the cows, coming back far enough so that they can not disturb each other, but not so far as to be in the way of the milker. I would always have stanchions to hold the cows while being milked, but would fasten with rope and snap for the night. These stanchions can be fastened to a long strip so that a number can be closed at once, which will save time. The stable should be wide enough to allow a passage-way back of the manure ditch, and shelves for the buckets and stools.

The milking stable must be kept clean if you expect first-class butter, for milk will be tainted if foul odors are allowed here. There should always be a little bedding in the ditch to absorb the urine, and the floor on which the cows stand should be cleaned and fresh littered before each milking. A barrel of land plaster should always be kept in the cow-stable, to be used as a disinfectant, as it will not only keep the stable sweet but add to the value of the manure.

Milking.—The milking should be done as quickly as possible and at the same time gently. No striking or yelling at the cows should be allowed; and it is best that the same person as far as possible milk the same cows. A cow will give considerably more milk if quiet and undisturbed, and milked rapidly, than if excited and worried.

Milking three times a day is recommended by some writers and practiced in some dairies, but with the exception of now and then a cow that gives an extraordinary amount of milk I should doubt if it would pay, as to drive cows up in the heat of the day and milk them would be a disagreeable job. I have for many years practiced milking but once a day, when the cows were giving but from four to six quarts a day, as is often the case in the winter. It takes but little if any longer to milk the cow once for the day than each milking would if she was milked twice, as most of the time is spent in waiting for

her to give down the milk and in stripping. With scales in the stable you can soon settle the question, and if you find as much milk can be had by milking once a day it is wise to adopt the plan. I greatly prefer a one-legged stool, as if the cow moves a little you can lean and keep near without lifting it.

Regular hours for milking are important, as the cows will give more milk than if sometimes milked early and at others late. If accustomed to milk at seven o'clock in the evening and six in the morning, and you occasionally vary to five at night and not till seven the next morning, the scales will reveal the fact that the extra milk in the morning will not make up for the loss at night. If you find you have a fractious, kicking cow, or one that milks hard, dispose of her at once, even at a loss. To whip a cow in the stable will often excite all the others and reduce the amount of milk from each of them.

There are times when the cows are liable to cracked teats, particularly in the spring or fall, and especially when the calves are sucking. Prompt attention to the teats at the first sign of soreness will save much trouble. Always keep in the stable some good salve for the teats. I prefer vaseline to any thing I have ever used; but mutton-tallow or glycerine is good. If the teats seem tender, or show any sign of cracks, moisten the palms of the hands with a little of one of these preparations, and it will soften the teats, and in many instances cure them in a day or two.

I think the plan of washing the teats in milk a filthy practice, and that in cold weather it is likely to make them crack. There should always be a towel in the stable, and a basin or bucket, to be used for washing the bag if any cow gets it soiled, and it should, after washing, be dried with the towel, as, unless this is done, the dirty water is likely to drip into the milk.

Milking Tubes.—I have never seen milking tubes that I should be willing to use regularly, or that could draw the milk from a cow as rapidly as a good milker, but I should not be willing to be without a set of them. Occasionally, with the best of care, a cow's teats will become so cracked and inflamed

that it is almost impossible to milk her, or a severe cut may make it quite so. Before I had milking tubes I was obliged more than once to allow a teat to dry up, and the cow was permanently injured from an accident of this kind; but with a tube I have drawn the milk from a badly-cut teat till it was thoroughly healed.

These tubes are made of silver, so as to not be liable to rust, and have openings on opposite sides to admit the milk, which flows through the tube into the bucket. They have also a slide on them which enables one to adjust them to different teats and prevents them from going too far up into the teat. They should always be washed after using, or they will soon become stopped. These tubes are small and can be carried in the pocket-book or vest-pocket.

MILKING
TUBE.

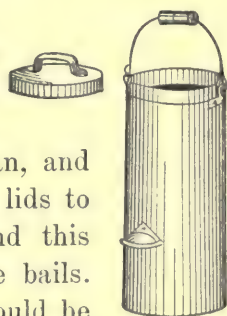
The best results will follow a thorough mixing of the milk. The theory has been advanced that, as the milk of different cows takes different periods to churn, there would be a loss of butter from mixing the milk. An experiment at the Pennsylvania Experiment Station showed just the opposite result. The milk of four cows was carefully weighed and divided for one week in January. Half of the milk of each cow was put in a common milk-pan and allowed to stand thirty-six hours before skimming. The other half was thoroughly mixed and then treated exactly the same as the first, in every respect. The result was that the mixed milk produced sixteen pounds six ounces of butter, and that kept separate, thirteen pounds eleven ounces.

How to Manage the Milk.—Aside from cleanliness in handling milk, there is no question of greater importance than that of temperature. The sooner the animal heat can be expelled from the milk the sweeter and better the butter will be. The best temperature for the milk-room is from fifty five to sixty degrees, and it should not be allowed to get above sixty-five degrees. The old method of setting in shallow, open pans is rarely, if ever, practiced now in dairies, as experience has proved that a better article of butter can be made with less

labor by deep setting. I have had ten years experience in deep setting, and can heartily recommend it, and I could not be induced to go back to the old system of open, shallow pans. The advantages of the deep-can system are: Economy of space and labor, easy control of temperature, perfect security of the milk from contamination by atmospheric influences, a larger quantity and better quality of cream and butter.

There are two opinions generally held which I have found to be erroneous, viz: that cream will rise better in shallow vessels than in deep ones, and that there is an animal odor about milk which must be expelled or the butter will have a bad flavor. Some writers on dairy matters have declared that milk shut up close as soon as drawn from the cow would become putrid and unfit for human food. No mistake could be greater, for milk may be shut up air-tight with all the animal heat, and if cooled rapidly down to sixty degrees or less, you will find on opening it that there is no offensive odor about it, but, on the contrary, it is fragrant as new-mown hay. I have also found in using cans twenty inches deep, that the cream would rise just as quickly, and in larger quantity, than when set three inches deep in open pans.

The form of the can which I have found best and most convenient is shown in the cut. These cans are twenty inches deep and eight in diameter, and hold four gallons each. If made more than twenty inches long, the bottom will strike the ground when carrying them by the bail. The handle shown on the side is to be used in emptying the can, and should be four inches from the bottom. The lids to these cans should shut over the outside, and this must be borne in mind in arranging for the bails. The ears to which the latter are attached should be set low, and should stand out well, so as to not interfere with putting on the lid. Make the lids quite flaring, so that they will go on readily, and when crowded down will be as nearly air-tight as possible. If the lid is made to shut inside the can it can not be shut so tight, and when ice is used



DEEP CAN
FOR MILK.

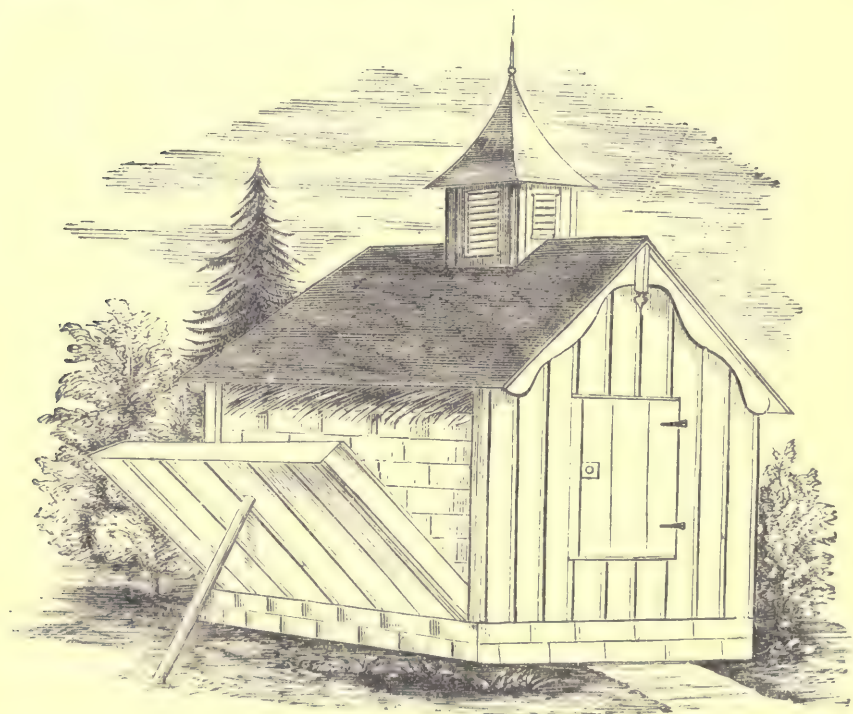
some water will be likely to enter the can. The cans should be made of the best tin, and this will be much cheaper in the long run, as they will be more durable. I have some made of what is called four-cross tin, which have been in constant use for ten years, and are still good. A can made in this way takes but little space for the amount of milk it holds, and presents so much surface to the water or ice-cooled air that the temperature of the milk can be reduced rapidly. There are two methods of cooling the milk—well or spring water, and ice. Cold water, where it is to be had in abundance, is cheaper than ice, and if one has a well from which can be pumped an unlimited supply, it will cost but little to arrange for setting the milk. A cheap milk-house may be made—merely a board shanty to keep off sun and rain—and in this place a box or trough for water, so arranged that it can be pumped directly into. The house may, if necessary, be some distance from the pump, but the trough must be lower, so that the water can be conducted to it. This box should be made wide enough so that two cans can be placed side by side, and be a little deeper than the cans. It will be necessary to arrange some way of fastening the cans down, or they will float and be likely to tip over when the water rises near the top; but this can easily be done by the use of small iron pins, or by wooden strips nailed to the inside, under which blocks or strips of boards can be slipped, so as to press on the cans and prevent the water from lifting them.

Have an arrangement for drawing off the waste water, so that it will run away through tile under ground, and not make a mud-hole near the milk-house. In the hottest weather you will need to change the water once or twice during the day.

Of course one may make a brick or stone milk-house, and use water in it as I describe, but as the temperature of the air will affect the milk but little when managed on this plan, and neither cats, dogs, nor insects can get access to it, a cheap building, or even a grape arbor that will furnish shade, will enable one to keep the milk cool and raise the cream successfully.

I have spoken of using water from wells rather than springs, because the springs in so few instances are conveniently located.

I would rather pump water to cool the milk than to have the spring-house fifty or a hundred yards away, and perhaps—as I have often seen—down a hill. If a cold spring can be had, conveniently located, it will be better than ice-house or well. If the well has an unfailing supply of cold water, a cheap wind engine can be used for raising it so to give all the advantages of a spring-house, or the water of a spring may by a hydraulic ram be forced to a higher level, and brought to where it is wanted.



ICE HOUSE.

Unless the supply of water is cold and abundant, ice will be found a necessity in summer butter-making. The ice-house may be made with some regard to taste and architectural appearance, or it may be a rough board shanty made by setting posts in the ground and boarding up with cheap lumber. All that is necessary to keep ice successfully is, that it be cut true and square so that it can be closely packed; that there be a sufficient bulk (I think that a body ten feet square and the same

height is as little as can be relied on to keep all summer, and the larger the bulk the less the waste); that there be sufficient packing around it of good non-conducting material to keep it from the air, thorough drainage, and good ventilation. Double walls are not necessary, but as less saw-dust will be required with them, it may be profitable to have them. To secure drainage, fill the bottom of the ice-house with stone to the depth of a foot, and then cover this with six or eight inches of saw-dust before putting in the ice.

A large window in each gable will give sufficient ventilation, and the ventilator shown in the roof may be built or omitted at pleasure. The windows in the gable should be always open to prevent the accumulation of heated air under the roof. The house should, if possible, be protected from the direct rays of the sun by trees. If this can not be done, it is well to have a grape-vine arbor, or some similar protection on the south and west sides. If there are double walls with a space of four or six inches, a foot of space between the ice and the inner wall will be sufficient, but if a building with single wall is used I would leave sixteen or eighteen inches.

Saw-dust is the best material for packing ice, as it is clean and not likely to heat or mold. The space between the ice and wall must be filled with this, tightly packed, and the top covered to the depth of eighteen inches. It will be necessary to visit the ice-house daily as spring approaches, for there will often be an air-hole, and waste will begin even before the weather is very warm. Tramp round over the top, feel round the edges, and see that there are no cavities. It is advisable late in the season to remove part of the saw-dust, as that packed round the sides will fall as the ice is taken out, and the large mass of wet saw-dust makes it hard work to get at the ice, and I have known it to heat and cause the ice to melt.

It has been suggested that one side of the ice-house be arranged on hinges, so it can be let down to permit the more easy storage of the ice. How this can be done is shown in the engraving. This, however, is not essential. Place the ice-house where it will be as convenient to the house as possible.

Ice-chests.—Most ice-chests I have seen are expensive, heavy to move, and difficult to ventilate and clean, and when lined with metal they soon rust out and must be renewed. I think the only advantage they have over a plain box is, that they economize ice; and if the farmer puts up his own ice it is better to build a larger ice-house and use more ice than to save by the use of an expensive chest.



ICE-CHEST.

The cut shows an ice-chest which is made with sides packed with non-conducting material, and lined with sheet-iron so that the water, as the ice melts, flows down the iron and cools the air inside. I give this be-

cause with very slight modifications it will exactly represent the ice-box which I use for the deep cans. All the change necessary is to remove the shelves or slats on which the pans are placed, lower the upper floor so as to make the lower space two feet high and leave the upper apartment sixteen inches deep. This ice-box can be made of common matched flooring, and a size large enough for fifty or sixty gallons of milk will cost less than five dollars. It should be made deep enough from front to rear to hold two rows of cans without crowding, which will require about twenty inches of space inside measure. The floor on which the ice is placed, between the upper and lower part, should be of hard wood-slats, one by three inches, with cracks one and a half inches wide between them. I think it best not to nail these slats, but let them rest on strips nailed to the inside of the box, with notches cut in them to hold the slats in place. As the lumber will swell considerably when wet by the melting ice, the doors should be made with a crack of half an inch or more in width between them, and a batton fastened to one of them so as to project far enough to close the crack. In using this, set the cans in the lower part and place the ice on the slatted floor; as the ice melts, the cold

water drips down on the cans, but as the lids fit over the can, none of it can enter. The upper part among the ice can be used for butter, fruit, meats, and vegetables, which can be set on or between the cakes of ice in tin-pans or other vessels.

When the box needs cleaning, by taking out the slats and opening the doors, it is easy to get at every part of it. Such an ice-box can be used in an out-building, or a small room can be made adjoining the ice-house, which will save work in carrying the ice. If this ice-box is to be used in the house, proper arrangement should be made for conveying the waste water to a tub or drain. If the weather is very hot, or a large amount of milk is put in warm from the cows, it is best to set a cake of ice on edge between the cans in the lower part in addition to that placed on the slat floor.

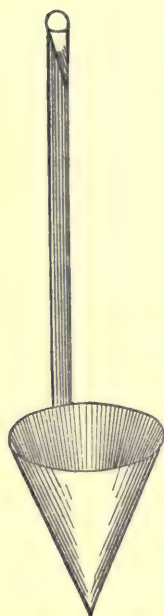
Causes of Bad Flavor in Butter.—There are butter-makers who know that every thing used in their dairies is sweet and clean, and that their cows are properly fed, who yet fail to make good flavored butter, but do not perhaps know the reasons. There may be several, for milk and cream are so sensitive that they can easily be damaged at any stage of the process of manufacture. One common cause of "off-flavor," is allowing the milk to stand too long before skimming. What is gained in quantity will not compensate for the loss of quality, for the first cream that rises is the richest, and each successive layer becomes poorer. I would not, under any circumstances, allow the milk to stand more than thirty-six hours, and think there is more loss than gain after twenty-four hours.

Another cause of bad flavor is keeping cream too long before churning; this is more common when but one or two cows are kept than in a larger dairy. Cream should be thoroughly stirred every time any is added to it, and should be churned before becoming so sour as to begin to separate, or "whey off," as our dairy maids express it. Perhaps the most common cause of bad flavor is failure to get rid of the buttermilk, for no butter can long remain sweet unless this is thoroughly removed.

Skimming.—When the deep cans are used for setting the milk, a ladle with a rather long handle is better to take off the

cream than a skimmer. The cream is so deep that little milk will be dipped up with it, and what is will be no disadvantage. The handle to the ladle should be nearly perpendicular to the bowl so as to enable one to use it easily when a can is not full of milk.

There is a style of can on the market which dispenses with skimming, as it is provided with a cock at the bottom to draw off the milk, the cream being left in the can; but when made with flat bottom, I would not recommend them, as they have two objections. First, the difficulty of keeping it sweet. Milk is so difficult to remove from tubes or pipes, and these sour so quickly and become so offensive if not thoroughly cleansed, that all vessels used for milk should be made plain, with every part easy of access. Second. With the greatest care there will sometimes be foreign matter in the milk, which will settle and adhere to the bottom of the can, and this would be left in the cream. It is not uncommon for a cow to give a small amount of bloody milk from one teat when you first begin to milk, and if the milking is done in a dark stable or at twilight the milker may not observe it, and it will be found at the bottom of the can, and if the milk is drawn off and the cream left in the can, it will be likely to contaminate it.



SKIMMER FOR
DEEP CAN.

In the best cans now in use, the bottom is made funnel-shaped, like the skimmer shown in the cut, and any sediment in the milk will gather in this and be drawn off first. They are also arranged with a glass tube for the milk to flow through, so that you can at once see when the cream begins to come, and stop the flow.

It is an excellent plan for those who keep but one or two cows to save strippings and add to the cream, so as to give bulk enough to enable them to churn every other day in hot weather.

Churns and Churning.—Probably no household implement has been the subject of so much study, or has so taxed inventive genius, as the churn. Churns of every conceiv-

able shape and mode of operation have been made,—rocker churns, swing churns, pump churns, crank churns, and churns invented by cranks, who either promise good butter in three minutes or twice as much as the cream contains. It is doubtful, however, if there has ever been a churn invented superior to the old dash churn, so far as making good butter is concerned, although there are others which are more easily operated.

It is generally conceded by all dairymen that it is not desirable to churn too rapidly, and fifty minutes is the quickest time in which they wish the churning done, and many prefer an hour and a half. The moderate, long-continued agitation, produces butter of a firmer, more waxy consistency, than more rapid churning. As the dash churn is too laborious for the dairy, I would recommend the square box or rectangular churn. I used one of them for several years, and found it easy to operate, and that it produces butter of excellent quality. It is simply a square box, with no dash or paddles of any kind. It is hung by two opposite corners and slowly revolved, the cream falling from corner to corner. It turns almost as easily with several gallons of cream in it as when empty. After the butter comes the buttermilk is drawn off, and the salt thrown into the churn, and by turning the churn slowly the butter is gathered and much of the buttermilk worked out and the salt well mixed.

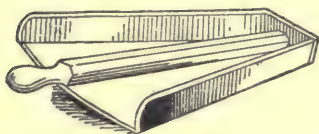
Some prefer to churn the cream sweet, but more butter can be made if it is allowed to sour slightly or “ripen,” and it is claimed that the butter has better keeping qualities than when made from sweet cream. If the cream is to be kept after souring, sprinkle a handful of fine salt over the top.

The temperature at which the best butter can be made is from fifty-five to sixty-five degrees; in summer a lower temperature is required than in winter, for it will rise several degrees while churning. Always regulate the temperature of the cream by a thermometer, as the quality of the butter depends very much on temperature, and no one can tell by the finger whether it is right or not. If the cream is too cold it will take a much

longer time to churn, and if too warm, the butter will be soft and white.

Firm, solid butter can be made in the hottest weather if the milk is quickly cooled and the temperature kept uniform. Food also will affect the texture of the butter, and a feed of grain each day will soon improve the butter, when the cows are on pasture and the quality is not satisfactory.

Washing and Working.—All the buttermilk must be removed or the butter can not be kept sweet for any length of time. Some wash with cold water, while others are of the opinion that butter will keep better that has never had any water about it. Either method will leave the butter in good condition if the buttermilk is all removed. The hands should never be used in working, and if a large amount of butter is



BUTTER-WORKER.

to be worked the butter ladle is not sufficient, and a butter-worker will be needed.

The worker shown in the cut is perhaps as good as any, and is simple and cheap, and can be made by any carpenter. It can be made of any size to suit, but should be two feet wide at the upper end and taper to four inches at the lower end. It should not be less than three feet long. It should be made of hard wood and planed and polished till perfectly smooth. A beech slab will answer for the bottom. The sides should be three inches high and leaned or flared out a little, and the legs should be so made that it will slope towards the narrow end, where there should be an opening for the buttermilk to run off. The lever can be made six or eight sided, and should be hung with a swivel hinge.

One method of washing the butter is to place it on the butter-worker after it is gathered, and as it is worked apply water from a sprinkler until it runs off clear. Another way to wash it is to stop churning as soon as the butter granulates and before it has gathered; remove the buttermilk by pouring it off through a hair sieve, so as to save any butter that runs off with the milk. When the buttermilk has all drained off, take

a bucket of cold water, hold it as high as you can, and pour it upon the butter in a stream large enough to force its way all through the particles, and fill up the churn until the buttermilk is so diluted that the water will not need to be changed.

When the butter has hardened sufficiently, take it out on to the butter-worker and add the salt and work it in. The amount of salt to be used is a matter of taste, and will vary from one-half to one ounce to the pound. The salt should be finely crushed under a roller and sifted. Careful experiment has shown that the addition of a teaspoonful of saltpeter and a tablespoonful of powdered white sugar to each twenty pounds of butter adds to the keeping quality and flavor of the butter. The saltpeter and sugar should be crushed and sifted with the salt and thoroughly mixed. Butter can be worked too much, so as to destroy the grain and make it sticky, and this must be avoided.

If the butter is not washed the buttermilk must be all worked out, and a large sponge, covered with a napkin, to press on the butter, will be a great help in removing it. To have the butter uniform in appearance it should be worked a second time after standing twenty-four hours, as there will often be white streaks—where the butter has not taken salt—if this is neglected.

Keeping Butter.—Although it is desirable to have the butter contracted and delivered fresh to customers, it is sometimes necessary to hold for a higher price, and there are several methods of putting it down for this purpose. Whatever method is used, all the buttermilk must first be removed by thorough working.

One method is to add sugar and saltpeter, as before described, and pack tight in firkins. Do not fill them quite full. Cover the butter with two or more thicknesses of cloth which has been wet in brine, and then fill the firkin to the top with finely powdered salt.

Another method is to make the butter up into rolls, and envelop each one in paper prepared for the purpose by coating

with albumen made from the white of eggs. A small amount of salt should be beaten up with the white of the eggs, and after it is applied the paper should be ironed with a hot smoothing iron. A fine, tough article of Manilla paper will be best for this purpose. These rolls should be closely packed in a stone jar and covered with fine salt.

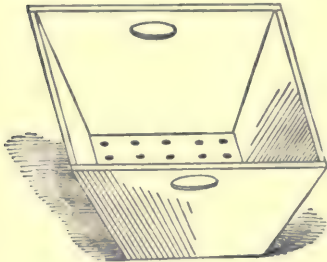
Brining Butter.—By this method the butter is made up in small rolls, and each wrapped in two or more muslin cloths and packed in a stone jar, and then brine poured over it. Brine for this purpose should be made hot and skimmed, then allowed to cool and settle, and strained before being poured over the butter. It is best that the rolls be made oblong, and weigh from two to four pounds each. The muslin should be soaked in strong brine before using, and must be put on the roll wet.

Rancid butter can be greatly improved by churning it in new milk and washing thoroughly with cold water. Another plan is to add a quarter of a pound of fresh lime to two gallons of water, beat it thoroughly, and after it settles pour off the clear portion and wash the butter with it.

Family Cheese Making.—The making of cheese for market can be better and more economically done in factories than in the family, but I see no reason why a family supply should not be made at the farm-house now as easily as forty years ago, when it was quite common. In 1852 I had charge of a dairy of twenty cows, and did all the work of making and caring for the cheese, and I think I can describe the process so that any one can soon learn to make good cheese.

But a small outlay will be necessary for fixtures, as the wash-tubs can be used for the whey, but a new, clean tub should be bought in which to set the milk. A cheese-basket, or drainer, with flaring sides and perforated bottom, will be needed to set over a tub to drain off the whey. A hoop, in which to press the cheese, which is best made of tin; a dozen cloths, which should be a yard square and made of cheap, coarse muslin; a press, a thermometer, a wooden bowl and chopping knife, a cheese ladder, a curd-knife, and a few smooth, wide shelves, on which to cure the cheeses, makes up the inventory.

The form of the cheese basket is shown in the cut. The sides should be flared, so that it can be used on tubs of different sizes. The holes in the bottom should be one inch in di-



CHEESE BASKET.

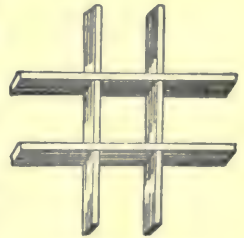
ameter, and there should be enough of them to give quick and free escape to the whey. The hoop should be of heavy tin, and is precisely like a peck measure with the bottom out; a good size for from five to eight cows would be ten inches in diameter and eight deep. It is best to have two sizes, as the quantity of curd will often vary.

A "follower" must be made for the hoop, by which is meant a round piece of board made to fit loosely inside of it to settle and follow up the cheese as it is pressed. It should be cut from a two-inch board, and have a strip screwed on to the top across the grain of the wood to keep it from splitting. This strip, if grooved at the sides, makes a good handle by which to lift the follower out of the hoop.

The press may be a cheap affair, and the simplest and best form is made with a lever, on which weights are hung to increase the pressure as the cheese needs it.

A screw press, however, will answer for the purpose. A common hash-knife will answer to chop the curd to get it ready for salting.

A cheese ladder consists of four pieces of wood, one by one and a half inches, put together as shown in the cut. It is convenient for holding the strainer, and also to keep the cloth out of the milk when the rennet is first added. A strip of tin will do for a curd-knife.



CHEESE LADDER.

You will need to provide rennet, and that which is a year old is considered the best. The best rennet is from a calf from one to four weeks' old. It should be emptied of its contents, thoroughly salted, and dried without any washing or scraping, and when dry should be put away in a dry place where it can be kept from flies and insects. To prepare for use, soak for

twenty-four hours in one gallon of warm water, rubbing and working often to get out the strength. Add as much salt as the liquor will dissolve, strain, let settle, and it is ready for use. If to be kept some time add the juice of a small lemon and about one-fourth ounce each of cloves, cinnamon, and sage. Bottle it and keep in a cool, dark place. The rennets, if dried and salted, will gain strength and can be used a second time.

In setting the milk, the temperature should be about ninety-six degrees. The new milk will be nearly the right temperature, but the milk which has stood over night must be warmed, and the better way to heat it is by setting a tin pail of boiling water into the tub. The cream may be removed from the night's milk and used for making butter. The night's milk should be heated while the cows are being milked, so that the rennet can be put in before breakfast, as it is important to get the work done during the cool of the day.

It will require some little experimenting to ascertain how much of the rennet liquid to use; but if made as directed, try a table-spoonful for each three gallons of milk. If it is much over a half-hour in "coming," increase the quantity; if much less, decrease it. The tub should be covered with a cloth, to keep it from cooling while the milk is curdling, and it should not be jarred by walking over a springy floor. When the milk has curdled, so as to appear solid, cut carefully with the curd-knife into strips an inch wide, and then across, so that at the top it will look as though divided into inch squares. In many dairies a knife with horizontal blades an inch apart, like the bars of a gridiron, is used to cut the curd so as to divide it into cubes an inch square. As such a knife would cost but little, I would advise that it be procured. It could be made of tin; or a light frame, with fine wires stretched across, would answer. I only used the strips of tin for a knife, and then, after the whey began to separate, and the curd hardened a little, lifted it gently from the bottom with a ladle.

All the handling of the curd, in the early stages, must be done with great care, or the whey will be milky in appearance, showing that the cream is being washed out. As the whey be-

gins to separate, spread the cloth over the top, and begin dipping it off as it comes through. As soon as you can dip up a half-gallon of whey, let it stand on the cloth in a dipper, as this will give about as much pressure as is needed at this stage. Heat some of the first whey dipped to a little above one hundred degrees, and pour over the curd. By increasing the pressure, and an occasional cutting with the curd-knife, and careful stirring, the curd will harden so that in about an hour from the first cutting it can be dipped into the cheese-basket. You will first spread one of your cloths in the basket, and dip the curd carefully into it, and then, by gently lifting the corners and drawing them to the center, you will press the curd and drain off the whey. As the curd hardens, you will occasionally slice it both ways and increase the pressure by drawing up the corners of the cloth, and folding them over the curd and placing a square piece of board on it and a weight—a smooth stone, of twenty or thirty pounds weight, can be kept for the purpose. In from one to two hours after dipping up, the curd will be solid enough for the press. It should be of such consistence that it can be crumbled between the thumb and finger. It should now be chopped fine, and one ounce of salt added for each five pounds of curd, and it is ready for the press.

It is desirable that the cheese be of sufficient size, and if one has but four or five cows, the curd can be kept over till the next day, and two put together. It can be kept on ice or in a cold spring-house, by spreading it out in slices in pans. A better way, however, is for two neighbors to co-operate and put their milk together, each making a cheese on alternate days.

Place one corner of a cheese-cloth over the hoop, so that when settled to the bottom it will cover the sides and leave enough to spread over the top. The edges must be folded over nicely and the follower put on. The pressure must be gentle at first, or the cream will run out and leave the cheese poor; but it may be gradually increased, and in a few hours the cheese is ready to turn. Take the cheese from the hoop and spread a clean cheese-cloth over it and press the hoop down around the cheese. Have the cloth placed so that there will be width

enough at one side to spread over the top of the cheese. Now lift the cheese and hoop together and invert it, so that what was the top of the cheese at the first pressing will be turned down. Spread the cloth over the top smoothly, and with the left hand hold the narrow edge of the cloth while, with a common table-knife, you tuck down inside of it the edges of the cloth that covers the top of the cheese. The object of this is to give a good smooth edge to the cheese and preserve a good shape. Part of the cloth will now hang outside of the hoop, while at the first pressing it was all folded under the follower. If the cheese remains in press more than twenty-four hours, it should be turned a second time, for if left too long the cloth will be likely to stick to it and tear the rind.

Curing.—The operation requiring the greatest care is the curing of the cheese. They should be kept in a warm room, but must not be exposed to drying currents of air, or they will crack. When taken from the press, each cheese should be rubbed with lard, and a bandage of new muslin pinned loosely around it. The spreading of the cheese will soon tighten the bandage. The great danger during the drying process is that the cheese-fly will find some crack in which to deposit its eggs, and the cheese be ruined by skippers. Nothing but vigilance and watchfulness will prevent this. They must be kept on smooth shelves, and turned and greased every day, the bandage being left on and the grease applied to the bandage. The cheese should be carried to a table to grease, and, before it is put back, the shelf scraped and wiped clean. When the cheeses crack in curing, strips of tough Manilla paper can be stuck on with lard to cover the cracks. The cheese will do for the table in about four weeks, and by this time should have a rind hard enough so that there will be but little danger from flies.

The Factory System and its Variations.*—It matters not by what plan or system dairying is conducted, success can only be secured, and maintained, by a close selection and breeding of cows, and that with reference to their qualities as milkers, and the adaptation of the milk to the requirements demanded of

* Contributed by JOHN GOULD, Agricultural Editor *Cleveland Herald*.

it in manufacture. The care and feeding of cows to secure profitable returns of milk, the continuance of the flow, the study of the market, and a purpose to place before the consumer the exact product called for, are at the foundation of the dairy industry. Beyond this lies the department of mechanical skill, a knowledge of the manipulation of milk, and its results of butter and cheese, that a perfect article shall be placed upon the market.

To accomplish this, dairying is naturally divided into two great departments, individual and co-operative. The advantages of co-operation in dairying are that the labor is greatly reduced, as in the factory two or three hands will easily manufacture the milk of several hundred cows; and while here and there in a private dairy a better article of butter will be made, and better prices realized, as a general rule the factory will excel in both price and quality, and the patron receive the cash, while the family dairy will often be obliged to barter at the grocery. As long as the products of the dairy were very largely of local consumption, the manufacture of butter and cheese would be an individual industry; but when they became a matter of extended commerce, method and system would follow as a result, and from this would come a massing of material—first, to produce as uniform a result as possible; and, second, to reduce the cost of production to its lowest limit. To this end, since 1868, we find all sorts of associate dairying springing up—co-operative, patron, cream-gathering, milk-buying, and other kindred ways, each system and plan having variations of its own to suit the locality in which operations are carried on.

The new methods at once called for yet larger dairies, and the great demand for the better and more uniform quality of goods called for a great increase of dairy territory, and now not only the original dairy districts of New York and Ohio, but nine or ten other States are largely engaged in the dairy industry, and the butter and cheese of the United States, instead of being articles of local consumption, find their way into every market on the globe.

Milk.—The discussion of the different systems of conducting the dairy industry of this country can better be understood by

asking what are the elements of good milk. The question of breeds will not be considered here, other than to state that the breeders art and skill has given us breeds of dairy stock specially adapted to butter, cheese, and a general-purpose cow, the latter being of particular value for sale in villages and cities.

Milk is at its best estate at the moment of milking, and success in manufacture is based upon extending this period of perfection, at least until the milk has been converted into the practical use for which it was intended. Milk may be said to be made up of butter-fats and caseine, with other minor elements, like sugar and organic or mineral matter. The caseine in milk does not vary to any considerable extent. So many pounds of milk will contain as a rule about so large a per cent of caseine. But the butter per cent varies very largely. Breed, feed, surrounding conditions, all have an influence, so that the amount of fatty matter in several samples of milk will vary, four per cent of butter-fats making a very rich milk, while two and a half per cent may be regarded as average quality.

The cream may vary greatly in production of butter. Different samples of cream, to the eye of similar appearance, will produce butter varying in quantity as three to one. In this respect the Jersey cow, well-fed, has her claim for superiority founded; for the best cream from native cows will only churn out from forty-five to fifty per cent of butter, while Jersey cream will give in return nearly sixty-five per cent of butter; so that the weight of cream is not a safe conclusion in respect to the butter yield; and, lastly, if a cow is not naturally a good milker and butter-maker, no system of feeding can force her to become one; though perhaps an increase may result, it will not overcome the inherited or natural milking tendency.

A Good Cow.—What is a good cow? Taking the average, the Ohio dairy cow may be said to give twenty pounds of milk per day for two hundred days, or four hundred factory gallons at ten pounds each, which at ten cents per gallon would represent an income of \$40. To this should be added forty pounds of butter made at the two extremes of the season, worth \$10; a calf, \$2.50 more; total, \$52.50. Many dairies go far above this

sum, \$70 per cow not being infrequent, while many poorly kept and cared-for dairies go even below \$40 per head. There can be no definite sum fixed upon as a point of profit, for the conditions under which milk is produced, the expense in production, and the circumstances of its disposal can not be fixed or regulated by commercial laws of supply and demand.

Maintainance.—The old plan was to allow five acres of land for the yearly maintainance of a cow, but the value of fodder-corn is being so rapidly recognized that the day is not far distant when this proportionment will be ample for two cows, which would double the income of the dairy, without a corresponding increase of capital, save in an increased number of cows, and the added labor that this increase would demand.

That dairying is profitable is demonstrated by the rapidity with which it is being adopted by different sections throughout the Union, and that once adopted it is never abandoned as a whole. As methods of manufacture are improved, and the quality of the products bettered, fine butter and cheese come to be regarded as indispensable articles of diet rather than luxuries, and hence are salable at any and all times and with a steady demand.

Handling of Milk.—The handling of milk, as stated, is by individual and co-operative systems, the last having the subdivision of the patron method of manufacture and sale. While the individual plan is far in the minority, yet it is the individual dairyman who, if he rightly conducts his affairs, obtains the extreme or quoted "fancy" prices, prices that he himself establishes and then maintains by his superior methods of excellence. By his individualism the private dairyman is enabled to control all his circumstances, have only the choicest cows, and make an article of butter exactly in accordance with the wishes of the customers he serves; while by co-operation there is a massing of collected material, and final selling in the general market, that has a tendency to lower quality and prices.

Modern Invention.—Modern inventive genius has been so active, and that with special reference to the wants of the dairyman who seeks to improve his methods, that to describe

the private dairy is to introduce the reader at once to cabinet creameries, revolving churns, and patent butter-workers, rather than tin milk-pans, float and crank churns, and butter worked by hand. It is possible for butter to be made quite as perfectly with the old process of open pans and dash churns as by the more modern methods; but by these last there is a convenience of working, a controlling of conditions of temperature and exactness in churning, that makes a uniform product at any time that can not be warranted by the other. Each element that enters into the securing of uniformity lessens the labor of manufacture, and at the same time makes yet more sure the quality, texture, and flavor of the product.

Lowering Temperature.—The first decided step in progress in butter-making was secured when it was ascertained that a lowering of temperature was a more perfect way to separate the butter fats from the milk than by either maintaining it at the natural temperature, or by increasing it by artificial means, and then allow it to fall to sixty degrees. To heat the milk was to make yet more fluid in substance the serums of the milk, and allow the fatty globules to ascend with less obstruction; while to lower the temperature to forty-five degrees by the use of ice was to rapidly widen relative or specific gravities between the serums and the fats, for cold would affect the caseinous portions the most in proportion, so that the density of the serums would increase so fast that the cream would be forced upward by the caseine as well as rise by the natural laws of gravity. The result in effect was even more than this, for not only was this increased difference in gravities conducive to a larger per cent of cream, but it also made outside influences almost wholly inoperative, and thus secured what had been before unattainable, uniformity in weight, texture, flavor, and quality of the product.

Deep or Shallow Setting.—While the inventors all had the one goal in view, perfect separation of the butter fats from the milky fluid, they have pursued different ways in attaining it, resulting in patents innumerable, and infringements unnumbered. The plan of setting milk in cold air has but few advocates, and

the Ferguson cabinet creamery is the only apparatus now sold that employs the agency of cold air, and wide, shallow pans in which to set the milk.

The usual method is to set the milk in cans about eight to twelve inches in diameter, and from twelve to twenty inches in depth, holding about three to six gallons of milk each, and surround the can with either very cold running water or ice and water; so that the temperature will be reduced to at least forty or forty-five degrees, and there maintained for about twelve hours, when all the cream will have been forced to the surface. One of these patent cans is furnished with a conical cover, the edges of which pass down the outside of the can, and are then fastened, when the can is wholly submerged in water. As air and water can not occupy the same place at the same time, the cover is secured from floating and the evaporation which rises from the encased milk is condensed upon the inner surface of the cover, and there collecting, runs down until it meets and mingles with the water. This excludes all outside influences of the air, and still affords ventilation by contact with the rapidly changing water.

Other patentees merely set the cans in water, allowing the surface of the milk full contact with the air. Other's pack ice about the upper half of the can, and by a metal partition allow the lower half to be surrounded by the air. Other cans have tube cores that allow the water to circulate through the center of the milk, and thus promote more rapid cooling, and so on to the end of the chapter of the inventor's imagination. Some very successful butter-makers avoid all patents by using a common twelve-quart tin pail, and set it nearly full of milk into a tank of cold, running spring water, which is the Swedish method, the original method of deep, cold setting.

The Centrifugal.—Within the past few years several candidates for dairymen's favor in the form of centrifugal cream separators have been brought out, the best known of which are the Danish-Weston centrifugal and the DeLaval cream separator, both alike in principle, yet differing in details. The principle employed is a rapidly revolving cylinder filled with milk,

whirling at about two thousand five hundred revolutions per minute. The rapid revolutions causes the caseine and the mineral matters of the milk, by their greater specific gravity, to seek the larger circumference of revolution, and this separation forces the cream, which, at the natural temperature of milk, is several degrees lighter in specific gravity, to the center of the cylinder, where it is found perfectly separate from the rest of the fluid. Experiments show that the cream thus obtained is perfectly pure, for the separation has been secured by an agency that discriminates between weights with exact precision, and that the separation has resulted in a per cent of cream shown to be 9 per cent greater than by the most perfect cold system yet invented, and $16\frac{1}{2}$ per cent greater than by the open-pan system of cream-raising.

Why the cold system is superior to the open-pan plan is, that the cream globules of the milk vary in size, and are forced to the surface exactly in the same proportion. The larger globules, by their greater diameter and consequent cubical contents, are quickly acted upon, but as the resistance is exactly inverse to their diameters, that as the globules diminish in size their cubical contents diminish faster than their surfaces, it will be seen that the smaller ones meet with a resistance that they can not overcome, and are thus held in suspension. The cold-setting plan so contracts the serums that more are liberated than by open-setting, and when acted upon by centrifugal forces, the density is yet more pronounced, and another per cent escapes, making the difference in one case 9 per cent, and in another $16\frac{1}{2}$ per cent. In cheese-making this would tend to make skim-cheese still poorer by subtracting $16\frac{1}{2}$ per cent more of fatty matter; but if for feeding purposes, it could be fully and very cheaply compensated for by feeding a ration of oil-meal, for the saving of half a ton of butter by this method would buy ten tons of oil-meal.

Superiority of the Centrifugal.—In brief, the superiority of the centrifugal consists first, in a perfect separation of the fats (for force is employed, rather than gravity); the cream is longer-keeping, owing to its complete aeration; is uniform in

texture; contains no clots, or solid matters, and effects of contamination from outside accidents, and the like. By immediate separation after milking, rather than subject to the delay of hours, the usual risks of "muggy" weather, thunder storms, illy-constructed milk-rooms, etc., are avoided, and their ill effects are not perpetuated in the butter, as is the case with any other system of cream separation. The improvements that are constantly being made in the centrifuge, and the great reduction in price, is making them an article that may soon be found in both private and patron factories.

Noticeable Results.—One thing is noticeable about the results obtained by the centrifuge. It does not matter how cleanly the process of milking may have been performed, it will be found that after passing a couple of thousand pounds of milk through the machine, a quantity of dark, dirty slime will collect upon the inner walls of the cylinder, and most offensive to the smell. As it can not be dirt or foreign substances, it is fair to infer that in milk there is a certain amount of impurities which might properly be termed "dead" matter, or excremental matter, from the lacteal glands—a fact which would indicate the extended keeping qualities of butter manufactured under the centrifugal process.

Associated Dairying.—Associated or co-operative dairying, in the United States, has assumed such proportions that it may be accepted as a fact, soon to be verified, that the system will soon become general, and thus supersede the individual plan, except in the case of milk-selling to the cities, and the supplying of favorite customers who are willing to pay fancy prices for an unquestioned article of butter. In the West, beyond a line drawn north and south through Elgin, Illinois, the cream-gathering system of butter-making is the general rule, and is practiced with great success, from the fact that to the farmers in that great beef and pork-producing territory, milk, to feed live-stock, is worth more than it could possibly be if made into cheese. East of that line, the joint production of butter and cheese is more general, and the subject will, therefore, be given separate description.

The Patron Cheese Factory.—The most common systems of cheese factories are the patron and stock, the first owned by the cheese-maker, who is sole owner and director. He makes the butter and the cheese ready for the salesman, for a stipulated sum per hundred pounds, this sum being subtracted pro rata from each man's butter and cheese each time a sale is effected. The dairyman delivers the milk at the factory once or twice per day, as the patrons may agree among themselves at the monthly meeting. The custom at all such factories is to make half-skims—the night's milk being set and skimmed at the farm, and then mixed with the morning's new milk, and brought to the factory. Often, when butter commands a better proportionate price than cheese, the farmer skims all the milk, leaving the morning's mess at home. The patrons elect a salesman, or often a committee of three, who sell the cheese, strike the dividends, and divide the net proceeds among the patrons.

The Stock Factory.—The stock factory differs somewhat in detail from this. The factory and its equipment is built by a number of persons, who subscribe shares of \$25 each to the amount of \$1,500, or the estimated cost. Officers are chosen (but more frequently an executive committee), who build the factory, equip it, canvass for patrons, and work up the matter in detail. They hire a foreman and assistants, and have official oversight; and the absolute cost of manufacture is charged to all patrons alike, proportioned to their patronage. They sell to local buyers, or consign to well-known commission houses in the general markets; and, after deducting expenses, and allowing six per cent interest annually on capital, the net result is divided. This reduces cost of manufacture to the lowest possible point, and at the same time secures the outside quotations of the supposed best markets.

The third example is, for a large-dealing firm, whose integrity is undoubted, to organize their own factory, receive the milk, manufacture it, place it on the market, and charge the farmers so much per hundred pounds for the whole transaction, including commission, freight, insurance, usually about two dollars per hundred pounds of cheese.

Milk Selling.—A most popular way, and one that is rapidly superseding all other plans upon the Western Reserve of Ohio, is the system of milk selling. The milk buyer either builds or rents an already existing patron factory, and proceeds to buy milk, he making such disposition of it as his judgment may warrant. The price is based upon New York quotations, the price of a gallon of milk being fixed about two cents below quotations for prime cheese, and made subject to rises and falls corresponding with the market. The payment for the milk is made monthly, usually ten days after the close of a month. This enables the farmer to know what his cows are doing each day, and their exact performance for the month. The farmer then has no interest in the result of cheese sales. The buyer fixes the price, but taken one year with another the milk seller usually fares quite as well as the patron factory man.

Private Factories.—Occasionally a private factory is met with where the farmer has a large number of cows of his own, and he equips a factory and makes, to all intents and purposes, a strictly prime factory cheese and creamery butter. The extent of manufacture in these factories varies from the actual farm dairy up to the near approach to the general factory, for where private factories are established it is usual to accommodate those who desire it by allowing them to bring their milk and pay a sum for the making and selling the combined products. There are great numbers of these "one vat" factories and creameries, but their transactions are generally with the local buyer of dairy produce.

Different Factory Systems.—The practices of the factory men in the handling of milk vary greatly with the different sections in which dairying is carried on. A large number of factories make full stock cheese exclusively, and allow no patron to skim the milk, either in whole or part, making at all seasons a market cheese known as full stock. Another factory will make half-skims at the extremes of the season, and full stock for the four or five summer months. A class of factories, usually milk-buying concerns, follow the indications of the market. When butter quotes high, the production of butter is

made the object, and the residue of the milk is made into skim-cheese. When the quotations of factory cheese are favorable, the milk is only skimmed at the rate of two pounds of butter to the one hundred pounds of milk, and if full stock cheese promises a fine showing, the making of butter is wholly abandoned for the time. In certain localities the milk is drawn to the factory twice per day, and butter is the prime object, full skim-cheese being made the year round.

At a Creamery.—At the creamery, for these factories are called creameries, the milk is received and weighed, and credit given to the patron, when it is run into a small vat, and thence drawn into the small cans and placed in tanks of water cooled with ice, where they remain twelve hours, when the cream is removed and the milk placed in the usual working vats, holding about six thousand pounds of milk each, and made into cheese. The attempt has been made at various times and places to substitute lard fats and oleomargarine oils in the place of the removed butter fats of the milk, but with indifferent success. To make an artificial cream, a small quantity of skim-milk is taken and heat applied to it until it indicates one hundred and thirty degrees. The lard is melted and the two elements are then mixed at the rate of two pounds of milk to one of lard, and put into an agitator, which, by rapid revolutions, in a time will reduce the two elements to a lathery cream, or “emulsion.” About two pounds of this cream is added to each one hundred pounds of milk, and the cheese made much as usual, except that the milk is set at ninety degrees, and sufficient rennet added to produce coagulation in fifteen minutes. The curd, after having been “cut” and worked, is next cooked, the temperature is raised to ninety-eight degrees, and manipulated in the usual way, the time consumed being upon the average about one and a half hours. After the curd has been drained, it is salted at the rate of two and a half pounds to each one thousand pounds of milk. The after care of the cheese is not essentially different from the ordinary makes.

A Full Stock Cheese.—The process of making the full stock, or cream cheese, is one of exact nicety, and only a gen-

eral idea can be gleaned from books, for the art of making the best cheese is one that must be learned by dint of labor and acquired by long practice. To make full stock cheese, the night's milk is not cooled any more than is necessary to keep it from changing, and in the morning the morning's mess is added to it, and the mass is warmed up to eighty-four degrees, when the rennet is thoroughly stirred into the milk, and after coagulation takes place, which should not be sooner than from thirty to forty-five minutes, it is cut up and partially wheyed off. It is then scalded up to ninety-six degrees, the mass being constantly stirred to even and thoroughly cook the curds. Before acidity shows, which it is sure to do after a certain time, the whey is drawn off and the curd "banked up" to take on a slight acidity and "break" down by the action of the air. The curd is then cut in pieces about the size of loaves of bread and run through a curd mill, which cuts it in small cubes, and is then salted at the rate of three pounds to each one hundred pounds of curd. The custom of developing acidity in curds before removing from the whey is being modified to a great extent, and it is now held that the most perfect acidity is obtained by exposure to the air, a process called by Professor Arnold "oxidation." If the whey is run off sweet, any bad flavors or influences which might have existed in the milk is carried with it, and not cooked into curds. If the curds sour in the whey, the developed acid neutralizes in part the fats, and a proportion of the mineral matters are released, detracting both from its digestibility and richness, and a dryer, harder cheese results.

The Curing Room.—The furnishing of factories with special curing rooms is essential, for the perfect curing of cheese demands a room, not abounding in light, one that is not subject to changes of temperature, but so arranged that the thermometer will indicate without much change seventy degrees. The air must not be dry, but a free circulation needs to be maintained. The devices of the curing room have been many, but as yet the shelf made of a wide, white-wood board is holding its own against all patented improvements, as a table or rack on which to cure cheese, though they need frequent scraping and scouring.

Supply Houses.—The furnishing and equipment of factories and creameries was once the province of local tin-smiths and machinists, but the business has been made a specialty by several great manufacturing firms, and the best method in erecting a factory or creamery is to invite from them proposals to furnish the supplies; and they knowing the exact needs, will make far better terms than can be secured by any other plan.

The Exclusive Creamery.—The erection of cream gathering butter factories all over the country, and at the rate of nearly six hundred per year, has elevated this special class of dairying to a most prominent place, and it is a most popular specialty. In the essential features of organization these creameries do not materially differ from plans detailed in previous pages, except in this, that the cream gathering plan is especially adapted for dairying in new sections, or where factories are not common. The making of cheese supposes the patronage of at least five hundred cows within a radius of three miles, but with cream gathering, the bulk and weight of freightage is reduced to about one-twelfth of the milk total of a cheese factory. The cream gathering can thus be extended over a very large territory, and as dispatch is not so necessary as when milk is taken, the cream gatherer may extend his route over twenty miles and collect the cream of at least two hundred cows daily.

The General Plan.—The most common plan pursued by the patrons of this system, is for some one to erect and equip the factory, and buy and collect the cream, paying a stipulated price per inch for the same, an inch of cream being a basis of calculation for one pound of butter. An inch of cream is the depth rising on a can of certain diameter, 113 cubic inches in amount being taken to make one pound of butter. This is not perfectly accurate, for one inch of cream from well-fed, high-grade cows, will make twenty ounces of butter, while another dairy will produce cream so poor—that is, the caseine element so predominating—that a like amount of cream will not make over twelve ounces.

The plan of gathering is as follows: All the patrons are provided with milk-cans of one make, "Standard," "Fairlamb,"

“Cooley,” “Wilhelm,” or other pattern, and each farmer provides facilities for cooling the milk, either with ice-water, or an ample supply of well or spring water. Rules govern the feeding and milking of cows, the idea being to secure at the start as great uniformity as possible. The milk is strained into cans, which are at once placed in the water-tank to cool. The cans remain undisturbed until the cream gatherer arrives, who makes a record of the inches of cream upon the cans by the means of a glass gauge let into the side of the vessel. The cream is then deftly dipped off by the use of a conical cup and long handle. The milk is then at the disposal of the farmer, and the cream gatherer drives to the next farm. There are other ways of determining the usual amount of cream, the next best way being to collect all the cream from the cows of one dairy in a pail with a diameter of twelve and one-half inches, and thus measure the mixed cream by the depth in inches. One other plan is to buy cream by the gallon, assuming that such an amount will make two pounds of butter.

Nearly all cream buyers sample the cream of the patrons, and by churning a small quantity (a measured quart of cream), ascertain to a nicety the exact butter value, and figure this cream account accordingly, as by this process it is found that some dairies only require ninety-five cubic inches to make a pound of worked butter, while others demand one hundred and twenty cubic inches to accomplish the same result. By this system a dairy is credited with its exact performance, and establishes equitable relations between dairies that have never before been possible, and proportions to each patron his exact share, no more and no less.

Co-operative Creameries.—In the Eastern States a large number of cream-gathering factories are run strictly upon the co-operative plan. A stock company erect the creamery, and the cream is either collected and the butter made by contract, or skilled labor is employed so that the cost of manufacture is reduced to the lowest possible limit. The butter is consigned to the Boston market, and the returns are divided *pro rata*, after deducting all expenses, interest, and wear and tear of apparatus.

Where creameries are at comparatively short distances from the principal markets, this is a very satisfactory method of conducting the establishment.

A New System.—In some sections a yet different system is being introduced in regard to the management. Instead of collecting the cream, the new, fresh drawn milk is taken to the creamery morning and evening, and is accurately weighed. The seller accepts a contract price for his milk, or agrees to the market price, a price paid at the milk buying factories, or yet a proportionate price to the butter value of the milk. The creamery man extracts the cream and returns the skim-milk to the producer without cost. This enables the farmer to realize market prices for his milk, and yet have its feeding to augment the growth of his young stock upon the farm.

Creamery Butter.—The process of making butter at a creamery is very interesting, not only from the dispatch and skill noticed, but also the systematic treatment of the material during the entire process. The person who visits the different farms to collect the cream has a suitable spring wagon, and a cream-can so constructed that the cream can not be agitated while in the transit, as “churning” the cream while gathering en route would be to defeat the object of high-grade butter.

When the cream arrives at the creamery, it is placed in cream vats, holding often several hundred gallons, where it is frequently stirred to thoroughly mix the cream from the different dairies, and thus divest it of its identity so to speak, and secure ripening. This last, as distinguished from souring, is to promote acidity in a mild degree by the action of the air, rather than to secure another form of acidity by the ferment of the milk which the cream contains, the ripening being conducive to a delicate aroma so distinctive of choice butter, and to be distinguished from the higher, sharper flavor that naturally results from souring the cream—the formation of lactic acid from the sugar of the milk being the cause of the latter.

The first appearance of the acidity is the time chosen for churning. In all creameries the churning is done with revolving churns of some pattern, ample in capacity to produce at least

one hundred pounds of butter, though many are much larger. It is now more generally recognized that a more perfect separation of the butter takes place at a somewhat lower temperature than formerly employed, and fifty-eight degrees may now be said to be the accepted temperature for churning. The process of churning should occupy nearly one hour, and should be continued with regular revolutions of the churn.

The theory of churning is now held by advance scientists to be not a rupture of membranous sacks inclosing the butter globule which can not be proven to exist, but by the developing of a new agency by the concussion produced by agitation of the cream, named "Hydrate of Caseine." This new element promotes adhesion among the butter particles and visible butter results as soon as the development is active enough. Be this as it may, the churning at low temperatures is best, for undue heat excites cohesion in the caseinous elements, which by greater heat attach themselves to the butter globules, and a butter highly charged with caseine, and white, soft, streaky in appearance, is thus made from sound, well-produced cream, and as a rule the result of excessive warmth in the churned cream.

As soon as the butter has arrived at the granular stage, the operation of churning should be suspended, and the buttermilk drawn off. This can be best facilitated by first adding to it a few gallons of weak brine or pure cold water to the butter, and allowing it to permeate through the mass, aided by a few turns of the churn. This "cuts" the caseinous matter and makes more perfect separation. As soon as the buttermilk is drawn off (and all escape of fine particles of butter can be avoided by the use of a fine wire or hair sieve), the butter is submitted to the washing process with very cold water, to remove the remaining traces of buttermilk. This may be continued until the fluid runs clear, when the salt may be added and worked in by the revolutions of the churn. The butter is then removed and allowed to stand for about four hours in a temperature not above fifty degrees, when it is placed upon a butter-worker and worked free of moisture, and then packed into well-soaked ash packages for market.

The Keeping of Butter.—The keeping of butter is more dependent upon its perfect separation from the caseine than any one other condition, and it is now asserted by the highest living dairy authorities that this separation is more perfectly obtained by washing with pure cold water, with or without salt, than by any process of working to expel this undesirable element. Only the purest water should be employed for washing, and if a suspicion exists that the water is even slightly defective, salt should be used to neutralize such contamination.

Working Butter.—In working over butter great care must be taken to avoid any process analogous to grinding, or that would in any way break down the grain of the butter, for such treatment has the effect of giving butter a waxy, greasy appearance that detracts from its value.

Packing Butter.—In packing butter for market, the utmost care must be taken to have the butter salted to meet the demands of the consumer, a half ounce to the pound being ample for some consumers, and with others a full ounce will be required. The office of salt is not to preserve the butter, but to hold in check the other elements that it contains in spite of all efforts to remove them, and if possible prevent ferment, and the development of acids and gases that first manifest themselves in “off flavor,” then “strong” flavor, and next “rancidity,” the last step being the soap-grease stage of worthlessness; hence great caution should be exercised in having not only the buttermilk fully expelled as possible, but also to have the surplus moisture absorbed so that only the butter remains, thirteen per cent of moisture being the maximum amount of water in prime, well-made butter.

Sweet and Sour Cream Butter.—The question now of sweet and sour cream butter is beginning to become a prominent one, and many erroneous impressions and suppositions exist even among butter-makers who regard themselves as well-informed. The common error is in supposing that sour cream makes the most butter. Accurate tests do not warrant the belief, nor that sour cream butter is the longest keeping article. It is true, however, that butter-makers, as a rule, succeed best with acid cream,

and from the fact that they have pursued the same method in both cases, and attempted to make sweet cream butter by the same process as with the sour, inviting failure from the very nature of the conditions existing.

It needs no proof when it is said that acidity is one of the processes of decay, though decay is not necessarily immediate, and that souring can not create a better flavor than the natural one, though the consumer by habit may have come to acquire the preference for an artificial flavor in butter, just as one often prefers fruit pickled to give it a smart, acrid taste, or flavor. The great difficulty in succeeding with sweet cream butter will, as a rule, be found in imperfect churning, resulting from churning at the same temperature used with sour cream, so as to make the one come as soon as the other. This high temperature curdles the caseine, and causes it to adhere to the butter instead of being made independent of it. The butter thus charged with caseine gives it a light color, prevents solidity, and does not give sufficient length of time in churning to bring the smaller butter globules into adhesion with the larger ones, and they go off in the buttermilk, making a double loss, for the butter is weighted down with undesirable caseine, and the buttermilk is rich in butter globules. If churned at fifty-six degrees, it would have taken a longer time, it is true, to bring the butter, but natural adhesion would have united the butter globules, and the lower temperature would have held the uniting of the caseine and fats in check, and a perfect separation without loss would have resulted.

Another serious defect in the usual course pursued with sweet cream, is to mingle creams of different ages or skimmings under the impression that they are alike unchanged, but when together each will have its own period of granulation, and to churn all, overchurns the oldest, and in this way defective butter must result. When the amount of cream at each skimming is sufficient for a churning, a uniform butter can be made, but only under rare circumstances with mixtures.

If acidity is allowed the souring strikes through the entire mass, and makes it uniform, for the uniformity to be secured is

not in the butter globule, which is not easily affected, but in the serums of the cream. Thus it will be seen that to get good, sweet cream butter, imposes several conditions that are not demanded with acid cream, and with a great mass of producers outside of the creameries it will be found that the making of butter from slightly acid cream will, in a majority of cases, be attended with the most satisfactory results. Therefore, in dairy practice the acid method will probably predominate, and may be said to be the best plan for dairymen to pursue. Should the centrifuge become of general adoption, it is probable that sweet cream butter would then become generally made, but with either the cream gathering system or the drawing of milk to butter factories, changes will occur in the condition of the cream that will demand that a slight but uniform acidity shall be developed as the cheapest and readiest way to make a uniform butter. The acid should never be allowed to go beyond the first perception before churning, and the churning of sharp, sour cream should forever be prohibited by progressive dairymen.

Gentle Warnings.—Reforms come slow, and the march of improvement is scarcely faster. At best it will be years before the full adoption of improved methods, mechanism, or co-operation in manufacture will become general, and to this end, warnings, entreaties, and gentle admonitions will not be out of place for years with those who are slow to keep pace with the march of progress. While the factory and the creamery are yet far from attaining perfection in results, they are surely making great improvements, and in uniformity are far in advance of the general dairy masses in production. Many instances of great perfection are noticed in the butter made at private farm-houses and individual creameries, showing that if the close observation and skill of the few could be attained by the many, a great advance would be made, which would add millions of dollars annually to the revenues of the dairymen.

Wastes of the Dairy.—In the manufacture of the dairy there is a large amount of waste, in the form of whey, buttermilk, washings of utensils, and the like, that is valuable as food for stock, especially for hogs and calves, when fed in con-

nection with grain. Sweet whey contains four per cent of milk-sugar, a slight per cent of fats, and some caseine, so that a fair food-value is found. The value of this whey is proportioned to the amount of fatty matter the factoryman allows to escape. The whey made from skimmed milk is very poor in nutritive qualities, and is then only "drink." Whey fed to calves in limited quantities, and then along with grain, is beneficial to some extent; but if fed exclusively upon whey and grass, the young things might, with great propriety, stand for a picture of "Famine."

Whey has a commercial value from which to extract the sugar of milk. Sugar of milk has a very high market value among druggists, as an ingredient in the compounding of medicines; but the process of extraction is so difficult that the attempts to manufacture it in this country have been abandoned.

The buttermilk is the most valuable part of the wastes, as it is very rich in the nitrogeneous elements, and when properly fed with the carbonaceous foods, it is of great value to small stock.

The feeding of these wastes to hogs is accounted as a detriment to very fine dairy products, as the stench arising from the stock-yards, when this liquid food is fed, is at times almost unendurable; so that factorymen often run these wastes into the nearest stream, while others allow the farmers to draw it away to be fed at the farms, it being usually regarded as worth the transportation.

CHAPTER XII.

CATTLE HERDING.*

BEFORE giving my experience in cattle herding in Kansas, I wish to give some facts concerning the cattle business of this great State. While more or less cattle had been raised in the State previous to that date, it was not until 1866 that the trail was opened from Texas, and a year later that the advance guard of the great army of cattle reached Kansas. During the summer of 1866 a number of capitalists who had faith in the future cattle business hired a party of experienced herders and frontiersmen, and sent them from Abilene, Kansas, to Texas, to seek out the best route for a cattle trail. This party selected the best crossings for the numerous streams, and avoided, as far as possible, any stretches of barren lands. They also made arrangements with the Indian tribes along the route by which the herds were allowed to pass through their country. The first herd was taken through by a guide, and henceforward the trail was as easily followed as the great national road from Washington city to St. Louis.

I am indebted to the North Topeka *Mail* for the following, relative to this business: In 1866 the drive north commenced, and it is generally supposed that during that year, 260,000 head passed from Texas to the Indian Territory, destined for points in South-western Missouri. The following year the drive, though considerably less, in point of numbers, was the first made to any established shipping point in Kansas. Abilene, on the Kansas Pacific Railroad, was the place at which about 35,000 head were delivered during the year 1867. Here the Texas Long-horn obtained the first foothold on Kansas soil. Abilene was the drovers' market for three or four years subse-

*Contributed by EDWIN W. BROWN.

quent. 1870 was the prosperous year for this city on the plains. But her glory and prosperity as a cattle market attracted the attention of other towns, and they became rivals for the trade the coming year. Newton, Wichita, Great Bend, Caldwell, Hunnewell, Ellsworth, and Dodge City, all came in for a share. Below we give the drive from the State of Texas to the States and Territories north of it, commencing with the close of the war, up to the present date:

1866	.	.	.	260,000	1876.	.	.	321,998
1867	.	.	.	35,000	1878	.	.	265,649
1868	.	.	.	75,000	1879.	.	.	257,927
1869	.	.	.	350,000	1880	.	.	394,784
1870	.	.	.	300,000	1881.	.	.	250,000
1871	.	.	.	600,000	1882	.	.	250,000
1872	.	.	.	350,000	1883.	.	.	275,000
1873	.	.	.	405,000				
1874	.	.	.	166,000	Total,	.		4,707,976
1875	.	.	.	151,618				

In the following pages I shall try to impart a little knowledge gained by experience and by mingling with stockmen, that will, I trust, be of value to the novice, at least. Let no one imagine that to be a herder he must be a ruffian, a desperado, or a boor, for none of these qualities are essential; but, on the contrary, he may be a gentleman, a scholar, and a Christian, and the more of the Christian virtues found in his composition the greater will be his chances of success; for, in such a case, he will be an honest, kindly-disposed, merciful man, who will care for the dumb creatures committed to his care to the very best of his ability, and be ever watchful and on his guard against any and every foe of the herd. He will see to it that they have the best food, water, and shelter possible, and as a result of this care and attention his herd will be a thriving, healthy one, and success will crown his efforts. He may make some mistakes that will entail loss, but experience, though a hard and exacting teacher, is a good one. To be forewarned is to be placed on a vantage ground, for which reason I shall tell you how and why I and others failed, and suffered loss.

All are aware how often we have what we call hard winters, when the mercury falls below zero twenty or thirty degrees,

and the sun seems to lose his power, and every thing is frozen up tight for from eight to ten weeks, and between the first weeks of November and the last of March a half-dozen or more storms sweep over the land, bringing suffering and death to unsheltered, poorly-fed stock.

I will now write of my own experience with a herd of Texas cattle direct from the trail, in one of the worst winters ever known in Central Kansas. The herd was a mixed one of three hundred and forty head bought at Solomon City in September, 1871, at \$13.50 per head. All seemed to be doing well until the 17th of November, when we were struck by the fiercest blizzard that I have ever seen, and which lasted seventy-two hours. It began with rain and sleet, but soon turned intensely cold. At the close of the storm I had six cows and one bull dead, while the whole herd was encased in ice and looked as if death had a fast grip on the most of them. The last two days of the storm I fed the best I possibly could in the corral by cutting from the sheltered side of a long rick of hay, built on its north-west side for a wind-break. Just as soon as possible I let the cattle out of the pen for water, but had to cut ice ten inches thick, and the cattle, not being accustomed to ice, were timid about approaching the water-holes, so that it was fully a week before they would drink as our native cattle would have done. I fed all the hay they would eat, yet every day added one or more to the number of the dead, and to my surprise six bulls died before the close of the year.

During all those weeks of frost and ice there was not one pleasant, sunny day; but the ice on our water was constantly growing thicker, so that I found it impossible to water sufficiently, and on New Year's morning I moved the herd about seven miles to running water and a stalk-field, where they learned to eat corn. From that time until February 22d I moved four times to get hay and stalk-fields. I also fed fifteen bushels of ears of snapped corn every morning. The weather having moderated, I returned home February 22d. I still fed hay and corn until the grass was sufficiently grown to afford good grazing, which that spring was well along in April.

After our return home our losses were confined entirely to those that got down at the watering places, an accident which would occur every few days in spite of our best efforts and most watchful care. When first put on the range, the herd, but especially the cows, wanted to travel all the time hunting for better grass, and would have tired and worn themselves completely down but for careful herding.

From the coming of grass my trouble was over. I did not lose a single cow at calving time, and with the exception of one cow, pulled down by the wolves, and a few calves torn to pieces by the same, and one steer that climbed upon a rick of hay and broke his neck in getting down, I met with no more losses. I wish to note some points about this herd to be remembered. I did not loose a steer but the one that broke his neck. Seven bulls out of ten died, while of the cows I lost about three out of five, and these included every old cow in the herd; also the ones that had calves running with them during the previous summer. The cows heavy with young seemed to endure the cold just as well as those not so forward, and without a single exception dropped their calves without the least trouble and all did well, while the calves were wonderfully hardy. Some were born on days intensely cold, but in every case got up and lived. One calf, I remember in particular, was born on a hill-top with the mercury at ten degrees below zero, and a stiff wind blowing, deserted by its mother for food and water, but to our astonishment, came bawling to the herd the next day, was owned by its mother, and lived and thrived.

As I think over that long, hard winter of toil and exposure, and its results, I now see that if I had bought only steers I would have made a success; or had one thousand dollars less been invested in cattle, a shed built, a well sunk, provided with pump and troughs for watering, I would still have been successful with a mixed herd. I have never seen a herd thrive and fatten as that remnant did, and on sale day they brought quite a little sum as a premium above the market price of the day. Had I the same herd to winter again, I should expect to take through not less than ninety-five out of every hundred.

I will now tell of one or two other herds. A. B. came to Kansas about the same time that I did. Invested all of his available money in a herd of one thousand head of Texas yearlings, and undertook to winter them on the range. The story is soon told. Without food or shelter—for the grass was buried in ice and snow—the miserable creatures perished by the wholesale, and when spring came nine hundred and twenty-five were dead, and all would have been had not the man sold out and fled the country, leaving the remnant in better hands.

There were scores of herds but little better off, yet the owners were not wholly to blame, for at that time the “tender-foot” was told repeatedly that cattle wintered beautifully on the range, and came out fat in the spring. The writer well remembers being asked by passers by that fall, “What are you cutting so much hay for? you will not want the fourth of it.” The winter range lies west in the region of buffalo-grass and of unlimited acres, but not east of the one hundredth meridian.

I will write of one more herd for the lesson there is in it. C. D. was a Texan with a number of large herds, some five thousand cattle in all. One of these herds was wintered quite near my own, and contained one thousand fine large steers, every one of which should have lived had they been cared for as they might have been. But the man in charge, with plenty of hay, simply let the stock run to the stacks, and not half of them could get a mouthful, while one-half of the hay was wasted, and the poor dumb creatures stood and starved and died by the hundreds, while the men being paid to care for them were off at the nearest saloon or bagnio steeping themselves in whisky and crime. These are not fancy pictures, but actual, hard facts.

The news of these disasters spread, and men came from all the Eastern cities and bought up the hides, in many instances just as they were on the carcasses of the dead animals. A novel way of stripping off the hides was adopted to expedite the work. An expert would skin the head and partly the legs; one team of oxen or horses was hitched to the hide and

another to the head; the whip cracked, and off came the hide with a rush.

To sustain my assertion that I would now take ninety-five per cent of my old herd through the winter, permit me to recapitulate somewhat. My first move would be to get the whole herd at the earliest possible moment into a stalk pasture, and teach them to eat corn before the first cold spell. When the cold weather came I would cut out all the steers, and corral and feed by themselves. I would either build a small pen for all the bulls in the herd, or tie them up where they could have the best feed and shelter.

The young cattle should have their quarters also. I could make all these apartments in my old round corral with but little trouble or expense. I would have, as before, the corral protected by a rick of hay on the east, north, and west. The young cattle, bulls, and cows should have sheds of hay, and if possible the steers. I would have a pump and trough so arranged that all the stock could drink without going out of their pens.

As to feed, I would use no more corn than I did before, except during storms, when I would double the amount, as little hay could then be fed unless already in the rack. But if my hay supply was ample I would bed thoroughly to keep the cattle from direct contact with the frozen earth. To the south of my corral I should have a feeding pen inclosed with barb wire, with a feeding rack of ample length to give room for all. Having made these arrangements, I am confident that one-half the work and the same feed, pluck, and vigilance would take the herd through as nearly entire as I have asserted, and with a most satisfactory difference in the outcome in dollars and cents in favor of the latter mode.

Herding.—If you buy Texas cattle they will be more or less wild at first, according to the way they have been handled, and not a little care and tact will be required to manage them. It will be well for you to hire an old hand for a time, until your cattle get familiar with your corral and with your herd-ground, and until you have cultivated their acquaintance, as you

must to know how to manage them. Always be gentle and quiet in your movements among your cattle. Accustom them to hear you sing in a sort of monotone, and you will be surprised to see how quickly they will know your voice and learn to be trustful and quiet in your presence. You will find this a great help in time of sudden fright and threatened stampede in your herd, or during a storm, when in spite of your best efforts you are drifting and momentarily expecting a stampede.

As the well-known voice of a trusted commander will hold his men to their deadly work in a battle, so your well-known monotonous song will keep your cattle together and hold those in front and near you in check, though beaten and buffeted by a wild and relentless storm of rain and wind. Should your cattle get the start of you and go off on a mad run, keep cool, think fast, and act promptly. If you have room, get your horse as quickly as possible a rod or so in front of your herd and a little to the right or left as the case may be (have all your help with you), which will cause the cattle to crowd from you, and in a little while you will have made a complete circle. Sing all the time in your natural voice. If you can not keep cool enough to do that, keep still until you can; don't scream or yell; watch closely, and just as soon as you see any signs of the panic being over, crowd your horses a little more in front of your cattle, so as to shorten the curve, and lessen the size of your circle. Don't try to stop them, but wind them up, and if possible on a spot of ground with which they are familiar, and your danger is over for the time, as your cattle will crowd closely together, keeping up their circular motion, and when once your herd is thus wound up, you can sing and rest your horse, until of their own accord they quiet down. This is what cattle men call "milling." After such a run do n't disturb your herd until they begin feeding of their own accord, and you must be exceedingly watchful and careful for a number of days, for it will take some time for them to get over it.

But suppose your stock are in the hills, and start for a run up or down a valley or canyon and towards you? Keep some little distance in front of them, and lead them out on to the plain,

where you can act upon the directions given. But if the start should be from you, follow up closely, and look out for and take advantage of a widening of the valley to work ahead, and if possible circle around and come back over the same track, or if you find room, mill them where you are. Quite often, if well mounted, by acting instantly, a run may be checked, but don't hold too tight a grip or they will be almost certain to break. Better drift a mile or two than, as sometimes happens, have a run of twenty-five or thirty miles, and not get back for three or four days, and then with a large share of your stock lame or foot-sore, and all looking as if just off the trail.

I have written thus at length of runs or stampedes, because they are very disastrous, if not properly managed, and blast one's hopes and calculations like a cyclone, and to show how they may be guarded against and controlled. I would not give the impression that they are of frequent occurrence, for a herd of wild cattle may be so well and carefully managed as to become tame and quiet, and as easily controlled as our common domestic stock. The writer has taken a herd direct from the trail and kept them through two seasons without having a single run that was not checked at once and with a loss of less than one per cent by straying.

Do n't hesitate for one moment to discharge either a lazy herder or one who is rough and reckless in his management of your stock. The first will be constantly letting your cattle stray off, and the latter by his boisterousness and rough handling will keep them wild and ready to run at every little disturbance. In short, the way your stock are handled will make all the difference between quiet, fat cattle and lean, wild ones, and on market day the gently handled herd will make a far more satisfactory footing up in cash.

During all pleasant or ordinary weather let your herd do just about as they wish within certain bounds; give them all the room you can; but if you wish to get along easily and pleasantly and bring about the best results, be as particular about your bounds as you would have to be if a field of corn unfenced was on each side of you, and in a little while your

cattle will not attempt to pass the line, or if they do, a single shout from the herder, though a half-mile away, will cause an immediate "about face," the herd obeying the word as readily as a well-broken team, very much to the surprise of the new-comer. But if the signs favor a storm, and the weather looks threatening, keep your herd well in hand, and (if it is in the winter season or your herd is just off the trail) pretty well rounded up all the time, and just as near to shelter or corral as feed and water will permit, so that if one of those sudden changes come you may be ready for it in a moment. I never corral for a summer storm, but if possible would do it every time in winter; yet there are certain conditions of a herd when it would be the part of wisdom to do so even in summer. For instance: your cattle have been frightened within a day or two, and are for that reason timid and restless; or your help may be partly away, and every thing seems to indicate a severe storm; or you may be for the day poorly mounted on an inexperienced horse. Many other reasons might be given that would point unmistakably to the corral. In brief, use well your eyes, ears, and good common sense about this matter and be fettered by no iron rule.

During the rutting season your beeves, including all the steers, should be herded by themselves. If the reason is obscure to the reader, it would not be, were he to see a herd with a dozen or more rutting cows at once, all in commotion and excitement, instead of quietly feeding or chewing the cud.

Selecting a Ranch.—In the selection of a location for the breeding and rearing of cattle, you must consider three all important points: Range, water, and shelter. In many localities nature has supplied all that is needed, in the abundant grasses, the flowing streams, and deep, precipitous ravines or canyons, where for ages animals have found shelter when the plains were swept by the fierce and biting blasts of winter.

Should you decide to take the chances of raising cattle on the range only, be exceedingly careful in selecting your ranch. See to it with your own eyes that your grass is abundant, and that the buffalo or mesquite is the principal grass, for it must

be your main dependence for winter, or from December on to the middle of March. All through the season of growth guard every rod of this grass that lies next your winter shelter and water that you can possibly spare from your summer grazing. Keep the cattle off from these chosen acres as carefully as you would the hand of a thief from your purse, that the grass may make a full and undisturbed growth throughout the entire season, so that when your cattle have been driven by the blizzards to the canyon, on the first let up of the storm, you can see them feasting on the rich and nourishing food (for such it is), without a long trip over the bleak prairie.

But change these conditions; let your cattle (as they naturally will) crop short all the grass near their shelter and water, leaving for your winter range the remote parts of your herd-ground, miles away (perhaps), and your chances of a successful wintering of your herd are wonderfully diminished, your hardships increased, and the probabilities are that in the spring the number of your hides may exceed that of your cattle.

Be careful that your water is pure (not alkaline), abundant, and easy of access, or you will lose many of the weaklings in the spring when all are comparatively weak. Experience proves to me that where an animal once gets down in the mud and water, no matter how promptly rescued, you may about as well strip off its hide. A few dollars spent in making a stone bottom to your watering places, and in making easy grades where the banks are precipitous, would greatly reduce one of the most serious dangers that beset the winter and spring herd. Neglect of these precautions sometimes causes disastrous results late in the spring. A late storm drives the stock that was all doing well into their old winter shelter, and in attempting to drink after the frost is all out of the ground, but before it has settled, one after another gets mired and drowned until the stream is filled with their carcasses, and the careless ranchman discovers when too late that one hundred dollars spent on his watering-place would have been a splendid investment.

Do n't try to winter without fencing your water and shelter, and it is by far the safest to fence a part, at least, of your winter

range. For this reason: A storm comes up, you are careful that your own stock is all safe in their shelter, and retire to your shack or dugout feeling that all is well. You turn in and sleep soundly, only to awake in the morning to find your herd completely swallowed up by a perfect sea of cattle that have been drifting in on you all night, and may continue to come for a week, seeking shelter, water, and food, in your favored spot, stampeded from other herds, or turned loose by their owners, some of them coming a hundred miles or more, and numbered by the thousands perhaps. In such a case, although you do your utmost, many of your own brand will be lost, and you will be compelled to resort to the great spring round-up and claim your stock. By all means make a good, strong barb-wire fence that will defend your herd while in shelter from the vagabond cattle of the careless herder or the possible incoming of a drifting or stampeded herd.

Fire-guards.—Those who have never lived in a sparsely settled prairie country have no adequate idea of the danger from fire, for which reason I will sound a note of warning by saying: If your range is so situated and the land of such a nature as will admit of using the plow, by no means neglect to protect your range from fire. If you had ever been burned out by the rushing, devouring flames, as the writer has, this warning might be unnecessary. I shall presume that you can use the plow by taking advantage of a recent shower. Run at least two good furrows around your whole herd-ground, and then, one hundred feet away, and parallel with the first furrows, two more; and then some time when the wind is dead, and before the grass is too dry, burn out your space between your furrows. You may think one hundred feet pretty wide for your guard. My reply is, that if you ever stand and watch a head fire rushing on to your range with only that little black strip of earth between your all and a fiery deluge, you will wish that your guard was one hundred yards wide.

Prepare yourself for the work when you burn out the center of your guard, for you will find it quite a job. Take your wagon with a barrel of water (one head out); have a strong new gunney or coffee-sack in the barrel for each man, which will prevent

the water from spilling badly; also a basket of corn-cobs that have been well saturated with coal-oil. Stick one of these cobs on the tail-rod of your wagon, light it with a match, and, with a wet sack in one hand, and your rod with the burning cob in the other, start backwards along your furrow, and you can light the grass as fast as you can walk. Watch sharply and constantly the outer edge of your furrow, that the most feeble blaze in that quarter may be instantly extinguished. See to it that the man firing the opposite edge of your guard keeps just abreast of you, for sometimes the wind comes in sudden puffs, and you must be ready instantly to master your fire, or away it will go, faster than your team can run, and you will be the means of letting loose the very enemy you are endeavoring to secure yourself against.

It is best to join in with some of your neighboring ranchmen to do this work, as the same guard may be so constructed as to protect several herd-grounds; and then you can have a strong force and push ahead rapidly with your burning, with little risk, and if the fire should "get out," the same force is on hand, and available to control it and save the range. When, in a still time, a puff of wind comes, it almost always falls a dead calm again, in just a minute or two, which generally lasts some little time, so that a number of willing men, armed with wet sacks, may beat out the runaway fire and save the range.

Take no avoidable risk, but use every precaution possible; and while you are in the business, don't forget to burn off thoroughly your stack-yard. Don't be content with a simple guard around it, but see that it is as bare as a cleanly-shaven face. Every year, thousands of tons of hay are burned in the west because men will take the risk of burning off their guards after the hay is stacked, or because of a narrow guard. A head-fire, in a gale, will pick up a piece of dried cow-dung and hurl it fifty or a hundred feet, and the instant it strikes in the grass, a new fire is started. I once saw such a fire cross the Smoky Hill River, with seemingly no check to its rapid advance.

If you do risk your range, on no account neglect to burn off three or four acres for a stack-yard. You will see men by the score stacking their hay right on the open prairie, with no protection whatever; but if all others are fools, you act wisely, and some windy day you will have hay and they will have none.

The Best Breed.—Our stock journals have devoted a large amount of space, of late, to the discussion of this important point: Which is the best breed for the stockman and the butcher, the producer and the consumer? Short-horns, Herefords, Polled Angus, and Galloways, each have their admirers and champions, ready to back up their opinions with a formidable array of facts and figures.

The truth is, each and all are good. But the question is, Which of these famous breeds will give the best results out on great prairies and ranges of the West? All agree that the ideal animal for this purpose must be hardy, and come of hardy stock, that he may endure the chilling blasts of winter and the hot winds of summer; that he must have the "get-up-and-go" qualities that make a good forager; that he must be compact and beefy; of such condition and build that neither meal-bin, oil-cake, corn-crib, nor a stall are essential for his growth and proper development. In short, that he must live, thrive, and fatten on the range, and go direct from the buffalo-grass to the slaughter-house.

The result of crossing any of these thorough-bred bulls on good, selected Texas cows, is such as to surprise all not intimately acquainted with the business. The calves of such a cross resemble the sire in a remarkable degree, and exhibit his best points so prominently that men well up in the business would judge these animals much higher bred than a single cross. We believe there is no family of cattle that will give the same improvement in the first cross as the Short-horn with the Texas cow; but it is observed that a further infusion of Short-horn blood is not an improvement for this purpose.

For the small stockman, with fifty to a hundred cattle, who can house and care for his animals, as Eastern men deem necessary, a good Short-horn bull is the best and will give the most

satisfactory results. But where cattle must graze the year round, or nearly so, and the best shelter possible for them is a canyon or the lee side of a hay-rick, and where they are as ignorant of corn, oil-cake, and the meal bin as of the solar system, then all will agree that we must look for the most hardy animal as the sire of our calves, if we would not be disappointed in results. This quality is prominent in the Herefords, Polled Angus, and Galloways, and the ranchmen who uses any of these breeds crossed on the Texas cow will not be far off the track.

Land Titles.—I am asked how the ranchmen acquire a title to their ranges. The most of them have no legal right, but are "squatter sovereigns," who maintain their footing by sticking together, and in many instances by a free use of the rifle and revolver. And in some localities hundreds of thousands of acres have been fenced by wealthy men, who do not own a foot of it, excepting a single quarter section (bought from some homesteader) that contains all the available water for a score of miles around. In all the vast domain of the United States no man, though he be a millionaire, can acquire a title to any more government land than any poor man. All must pre-empt, homestead, or take land under the timber culture act, and if he avail himself of all these different modes of acquiring land he can only secure four hundred and eighty acres, except by purchase from other parties who have gained their titles from the government in the same way, or by the purchase of railroad land, and of this only every other section can be obtained. In the State of Texas it is different, where all public land belongs to the State and may be bought in tracts to suit the purchaser. In the Indian Territory no white man has a right to go; but many are there of a certain class, and by marrying a squaw may acquire certain tribal rights, but not otherwise.

The real facts in the case are about these: A majority of the large ranches are so situated that their occupants are, as the actual settlers come in upon them, being pressed back from their old herd-grounds in spite of their united and determined

efforts against the ever-advancing tide of settlers. Their long lines of wire fence are being continually cut by the incoming pioneers, and men just as determined and cool, and just as expert in the use of the ready revolver (and with law on their side), are constantly pre-empting or homesteading the best quarter sections all over their ranges, and it is only a question of time who will be the victor, for the *actual settler will take the land.*

Many ranches are offered for sale because of this trouble, while others are on the market because the grass within reasonable reach of water has been almost completely tramped out by over-stocking, or by careless, lazy herding, the cattle being permitted to graze all the time, just as near to the water as possible, when each day should have seen them driven out just as far as the good of the herd would admit. Who wants a range where the stock must make a round trip of twenty or twenty-five miles for grass and water, or who would expect to realize satisfactory results in such a case? Persons selecting a ranch must be wide awake and wary, or they will make mistakes in this matter.

The area required to give the best results in the pasturing of cattle varies very much in different localities, and so much so that one can only approximate when he says four acres to the animal.

The new-comer will be most agreeably surprised to see how his herd will thrive, grow, and fatten, during a single season. In many situations your cattle will not see a fly after getting from the corral or bed-ground until their return to it at night, and during the whole day you will scarcely see a brush in motion, while the grass is of such a nature that your stock never scour, but lay on fat like corn-fed animals and make a truly wonderful growth.

New Beginners.—Those who have followed me thus far, in my attempt to say a helpful word for the new beginner, doubtless see that I am not in very hearty sympathy with the great cattle ranches of the West. There are thousands of locations, however, where a man may settle and begin with a few

cows, and just as sure as he stays, he wins—provided that he displays the same energy, care, and forethought that would be required to successfully conduct any of the ordinary means of gaining a livelihood. With a dozen good cows and a good butter-maker, a support for a family can be gained from the butter, while the cows, with proper care, will grow into a herd, worth a respectable fortune, in ten years.

The rule should be to never part with a good heifer-calf as long as she breeds, or with a steer until three years old. Any man who can command money enough to start with fifty cows, may, by the time he has the business learned, be so well fixed that he can sell one hundred beeves annually, and this number will rapidly increase. I believe it best for those who have no practical knowledge of the business, to start with a few head of good cattle, and with every thing in good shape, for in such a case I can not see how a live man can fail. When I say good, do n't understand me to mean thorough-breds, for a good, healthy, native cow will be more hardy, and will bring forth and raise a calf with less care and risk, and will adapt herself to all the changes of the climate, live on rougher feed, and do better than a full-blood, while her half-breed calf will sell, as a beef, for just as much (coming off the grass) as your thorough-bred.

The stockman in Central and Western Kansas, Nebraska, or anywhere on the plains, must always market his beef directly from the grass. He may help a little by a rack full of millet-hay that his beeves may get at; but as a rule, every bit of millet or Hungarian should be stored safely for winter feeding, and all the corn that you can raise should be kept to meet any exigency that may arise—say, such a winter as I have described, or a loss of all or a part of your hay or range by fire. Where you prepare for winter with hay, millet, corn, sheds, etc., you require only about half the range that you would to winter without these accessories. Usually you may begin cutting grass in July, and if you wish, cut until the snow flies.

Markets.—The long lines of railroads all through the great West, have brought the buyer to the feed-grounds of our cattle-men, so that to-day every man may sell at home if he chooses,

or he may ship to Kansas City or Chicago, should he see fit; and if he has a No. 1 article, whichever course he pursues, a good price awaits him. All along the lines of railroad, good butter commands as good a price as in Ohio, being sent to Denver or a score of other towns and cities, and from thence distributed all over the immense stretch of country lying between Kansas, Nebraska, and the Pacific. The producer of a tiptop article of beef or butter need never fear a glut in his market.

Brands.—Brand every animal that you own, either with your initials or some simple device. 100 is a good mark, the curves are round, and not apt to blur, which they will frequently do if the curves are sharp, or the device too small. Before you adopt or use a brand, visit the county-town and have your brand registered, which will be necessary to make it hold good in law, and you can see that you have not a brand similar to some one already registered. Some men mark the ears with a knife, or saw off one horn, or cut what is called a dewlap, some with an upward and some with a downward stroke of the knife, in the thin edge of the skin just forward of the brisket, so that a part of the skin (say one inch wide and three or four long) will hang pendant and free. But all these knife-marks look barbarous, and disfigure the animal unnecessarily.

Branding-chutes and Corrals.—As no man not brought up on a ranch can ever hope to acquire skill enough in rope throwing to be of any practical use in lassoing or roping stock, every ranchman ought to have what we call a branding-chute, to be used not only when you brand, but on many other occasions, as when you may have a sick or lame animal, or wish to examine closely a fat one.

The entrance to the chute ought to be directly at the side of your corral gate, and so arranged that by partly opening the gate an animal would enter the chute instead of the pasture, with no risk of an escape. Let the entrance be about six feet wide, but contract in the length of a fence-board to about two feet and a half, or just so that a large animal can pass through by close work. It had better be made large enough to hold two or three large animals, close enough for calves, and strong

enough to hold the largest bull when mad from the pain of the branding iron. Let the exit be so arranged that the animal may be returned to the corral or let out to pasture, as may be required. There must be a platform made perfectly safe to stand on while branding, and the posts must be but two feet apart where the animal is to stand while the hot iron is applied, for some of them squirm around so as to make things lively. You must have a number of stout two by four pieces of scantling to slip in behind the animal across the chute to hold it still while branding. Another necessity for having posts but two feet apart is, that you may hold your animal just where you wish.

Your corral, for several important reasons, should be made round, with good strong posts firmly set but four feet apart, with the boards nailed on the inside, the bottom board within twenty inches of the ground, followed by at least five more, and about where a large animal's shoulders will strike; the fence should have two boards directly together, and when complete, have your fence full six feet high. These directions are for a corral to hold wild cattle, and experience will prove it none too strong, for when first corraled your cattle will be very timid, and a cat or dog or wolf will set them all in a turmoil, and the strongest possible pen will be broken if made square, for they will crowd into a corner, and the strength of hundreds of frightened steers will crush any fence like an egg-shell, and you will probably have a dozen or more killed before it gives way, or in the mad rush to escape which follows. But if your corral is made as directed, without the least obstruction on the inside for them to strike against, they will start off with a whirl and mill (as I have described), until they get over their fright. If, in the night, you hear your cattle running, repair at once to your corral, and sing as loud as you can, and your stock will quiet down much sooner. I have seen a herd of eight hundred cattle run in a round corral until exhausted, without breaking a board or hurting an animal, while a square one will be broken every time by a frightened herd of wild cattle, and the stronger you build it the worse for you, for if a common fence is built they will go through it with little damage, but if very strong

your stock will be killed and crippled by the dozen in their wild dash for freedom.

Texas cattle men all employ night herders, and in case of a storm have every man in the saddle all night long. In preference to risking their cattle in a corral, they take the open bed-ground; but my corral was never broken, and I never had but one animal injured by a run in it, and that one recovered. I will take the corral, properly made, and a good, comfortable bed with my family, rather than the open bed-ground with its risks, and spend stormy nights of Egyptian darkness in the saddle.

A corral two hundred and fifty feet in diameter will hold one thousand cattle. This may seem small for so many, but experience will teach you that your cattle will lie down on about one-half of it, if that half only is protected from a cold wind.

Castration.—The practice of allowing calves to run till six months or a year old before castrating, is reprehensible enough on a farm where but few cattle are kept, but infinitely worse on the range. During the period when your cows are dropping their calves, have in your pocket a knife with a blade keen as a razor, and castrate every bull calf as soon as dropped, if possible, before he ever stands up, unless he is to be kept for service. The calf will not flinch or struggle, or lose a teaspoonful of blood or notice the operation in any way if performed at this time. Do not neglect it. Some cut off the lower part of the sack, but it is best to make a slit for each testicle and leave the sack entire, as it makes a better show on a fat steer.

For young men of pluck and energy, who can command a small capital, there are still many good openings in the West for successfully prosecuting the cattle business. The better way to manage would be for three or four to unite, and this would relieve the camp-life of one of its worst features, loneliness, or the want of society, for with this number of intelligent young men together, the camp would be far more attractive and home-like than if a single man should start, and have no companions but the average cow-boy. With three or four partners there would be more leisure for reading and study, and one could always be detailed to look after the camp, while the herd need

never be left entirely in the hands of hired help. While there will be much hard work and exposure, there is also health and pleasure in the life of a herder, and no man has a better appetite or sweeter sleep than he who has been in the saddle all day.

There are many young men who, like "Wilkins Micawber," are "waiting for something to turn up," and who would be glad to engage in any honorable calling which gives promise of success. To such I would say that our boundless prairies are broad enough for you, and the business of cattle raising is not likely to be overdone; and with health, energy, and endurance on your side, you may engage in this business with a certainty of success.

In conclusion I will add, do not be afraid of the cow-boys; but treat them like men, and, if opportunity offers, generously, and my word for it they will pay you back in kind, "Gospel measure," and when you need help will give it with a hearty good-will. Just as the old pioneers turned out and helped one another in their log-rollings, house-raising, and corn-huskings, so will the cattle men help you to cut out (sort), brand, drive, car, and market your cattle, when it would be exceeding difficult for you to get along alone. On one or two occasions, after stormy nights, I improved my opportunities to return to their owners squads of strayed and drifting cattle, for which I would receive no pay, but afterwards got a hundred-fold return in all sorts of ways, besides the good-will of all the cattle men in the vicinity. A word to the wise is sufficient.

One word more about your winter herd. If possible, keep your cattle while on the range to the north or north-west of your corral, or shelter, in which case you can run home with no trouble when struck by a blizzard, which might be a big thing for you.

INDEX TO DISEASES OF CATTLE

	PAGE.		PAGE.
ABSCESSES (see horse chapter, page 723).		Inflammation of the Lungs (see horse chapter, page 694).	
Abortion,	912	Inflammation of the Pleura (see horse chapter, page 696).	
Ammoniacal Liniment,	930	Inversion of the Uterus,	913
Anæmia,	900	Iodine Ointment (see horse chapter, page 737).	
BATHING,	926	Itch,	920
Broken Horns,	901	LUNGS, CONGESTION OF (see horse chapter, page 691).	
Black-leg,	930	Lungs, Inflammation of (see horse chapter, page 694).	
Bloated,	903	Lung Fever (see horse chapter, page 694).	
Blown,	903	MAMMITIS,	917
Bronchitis,	902	Mange,	920
Bruises (see horse chapter, page 723).		Mexican Fever,	918
CAKED BAG,	917	Milk Fever,	916
Calving (see Parturition).		OPHTHALMIA (see horse chapter, page 708).	
Carbolic Lotion,	930	PARTURITION,	908
Catarrh,	899	Parturient Fever,	916
Choking,	902	Parturient Apoplexy,	914
Condition Powders,	928	Parturient Paralysis,	916
Congestion of the Lungs (see horse chapter, page 691).		Pleurisy (see horse chapter, page 696).	
Conjunctivitis (see horse chapter, page 708).		Pleuritis (see horse chapter, page 696).	
DIARRHŒA, (see, also, page 906.) . .	905	Pneumonia (see horse chapter, page 694).	
Dose for Young Animals,	928	Pulsation and Temperature,	899
ECZEMA (see horse chapter, page 704).		RHEUMATISM,	926
Enteritis,	907	SCABIES (see horse chapter, page 705).	
FRACTURES.	923	Sore eyes (see horse chapter, page 708).	
GARGET,	917	Spanish Fever,	918
Grain Sick,	904	Splenic Fever,	918
HOLLOW-HORN,	901	TEXAS FEVER,	918
Hoven,	903	Tympanites,	903
Humid Tetter (see horse chapter, page 704).		WHITE LOTION,	929
IMPACTION OF THE RUMEN,	904	Wounds,	920
Inflammation of the Bowels, . . .	907		
Inflammation of the Bag,	917		
Inflammation of the Eyes (see horse chapter, page 708).			

CHAPTER XIII.

DISEASES OF CATTLE.

PULSATION and Temperature.—The number of the heart-beats varies considerably in animals in health; but from a great many experiments the following is found to be an average in healthy animals: In the ox the heart beats from fifty-five to sixty-five times in a minute, and the natural temperature, as indicated by Fahrenheit's thermometer, is from one hundred and four-fifths degrees to one hundred and one and four-fifths. This is, of course, taken from adult animals, while in very young calves the pulse may be almost twice as fast, but the temperature will be about the same as in the adult. In very old animals the pulse will be slower than that given, still the temperature remains practically the same.

In the horse, the heart-beats number in an adult from twenty-five to forty, while the temperature is from ninety-nine to one hundred. The same remarks hold good regarding the young and aged as spoken of regarding the ox. As a general rule the heart beats from three and a half to four and a half times while the animal is breathing once. If this proportion varies to any great extent something is wrong, either with the breathing or circulatory system.

Catarrh.—**CAUSES.**—The same as in the horse.

SYMPTOMS.—First, there will be dryness of the lining of the nose; then these membranes become reddened and swollen, sometimes causing difficulty in breathing; the animal sneezes, and in a short time there will be a discharge from the nose; this discharge will be thin and watery at first, but it gets thicker and increases in quantity.

Catarrh may also affect the lining of the wind-pipe, as well

as that of the nose, and, in this way, may terminate in simple pleuro-pneumonia. Diarrhœa is often present with catarrh, and unless it is very severe it should not be stopped. Sometimes the appetite is gone. The quantity of milk (if it is a milch cow) will be decreased in amount, and the cud is no longer chewed.

TREATMENT.—If the diarrhœa is severe, give some of the remedies recommended for diarrhœa, but if there is no diarrhœa, give food which will tend to loosen the bowels; or, if the bowels are costive,

Take—Epsom Salts,	. . . . .	10 ounces.
Compound Tincture of Gentian,	. . . . .	2 ounces.
Tincture of Ginger,	. . . . .	1 ounce.

Mix, and give in thin gruel, and if the bowels do not act in twelve hours, repeat the dose; and,

Take—Laudanum,	. . . . .	1 ounce.
Aromatic Spirits of Ammonia,	. . . . .	1 ounce.
Flaxseed Tea,	. . . . .	1 pint.

Mix, and give in cold gruel three times a day; or,

Take—Aromatic Spirits of Ammonia,	. . . . .	1 ounce.
Fluid Extract of Belladonna,	. . . . .	1 dram.
Ale or Beer,	. . . . .	1 pint.

Mix, and give three times a day; and if there is much fever, add to either of the foregoing one ounce of sulphate of potash, until the fever is reduced. Causing the animal to breathe steam is useful, but be careful or you will choke it.

Anæmia.—Anæmia means poverty of blood. It is poverty of the red globules of the blood. It may be caused by loss of blood from a wound, or from calving, or by want of nourishing food, exposure to cold, etc.

SYMPTOMS.—All the mucous membranes are pale, or of a lead or slate color, instead of the natural bright pink color; the tongue, lips, etc., are soft and flabby to the touch; the animal is in poor condition; may or may not eat well, but in almost all cases the digestion is impaired. If it is a horse, he is easily fatigued when put to work, and slight, colicky pains occur from a very slight change or irregularity in feeding.

TREATMENT.—Place the animal in a comfortable place; clothe with blankets in winter, to make him comfortable; avoid any sudden changes of food, but carefully and gradually change the food to a better and more digestible variety, if possible; and gradually add a small amount of flaxseed-meal, or corn-meal, to the customary food, and feed him four or five times a day, giving but a small amount at a time.

Take—Sulphate of Iron, 2 ounces.
Gentian, powdered, 4 ounces.

Mix. Make into ten powders, and give a powder three times a day. Or,

Take—Saccharated Carbonate of Iron, 2 ounces.
Cinchona Bark, powdered, 2 ounces.

Mix, and make into ten powders; give a powder three times a day; but if the last is prepared for a cow, twice the amount of cinchona, given in the formula, may be used.

If a cow's head and horns are affected, anoint the head around the roots of the horns, and in the hollow behind the horns, with Ammoniacal Liniment, for which see Index.

Hollow-horn.—This is a term which is often used to designate some debilitated condition, and catarrh is not unfrequently mistaken for what is called hollow-horn. Anæmia is another condition which is often called hollow-horn. All cows' horns are hollow, but in old cows, or those that are greatly impoverished from disease, exposure, or want of food, the hollow will be larger than in a younger cow, or one better cared for. For treatment, see Anæmia and Catarrh.

Broken Horns.—If a horn is only slightly cracked, and not broken off, it may be tied to its place, and allowed to heal, without removing the broken part, by wrapping it tightly with a strong strip of tarred cloth. If it is severely broken, remove the detached part, together with any rough or projecting parts, and apply a tarred cloth to the end of the horn, and wrap another tarred cloth around the horn, to keep this in place; or, if the horny part is broken and pulled off, leaving the bone in its place, wrap with a tarred cloth as above, without removing the bone, and a new growth of horn will be produced. In this

last case, the tarred bandage must be applied tight enough to stop the bleeding. Usually nothing more is needed, unless maggots get into the part. If maggots do get in, it can usually be known by the uneasiness of the animal. It is necessary, in such a case, to remove the bandage, and apply turpentine until all maggots are destroyed and removed; then bandage as before.

Bronchitis is an inflammation of the wind-pipe.

SYMPTOMS.—The breathing will be irregular and wheezing; the pulse will be quickened, it may be, eighty or ninety beats to the minute; the cud is no longer chewed; and, if it is a milch cow, the amount of milk will be decreased; the nose will be dry and hot; a cough will be present, and a discharge from the nose, as in catarrh.

TREATMENT.—The same as for bronchitis in the horse, giving about one and one-third as much medicine to the cow as to the horse.

Choking.—Choking occurs in all animals, but it is most common in cattle.

CAUSES.—Failing in an attempt to swallow some half-chewed food, or some hard substance, as an apple, potato, etc.; choking from half-chewed food is, in most cases, the most severe. Thorns have been found lodged in the throat of a cow. The offending substance may be lodged in either the throat, neck, or back in the chest.

SYMPTOMS.—The symptoms are most alarming when the body causing it is in the neck. When an attempt is made to swallow signs of uneasiness can be seen, and if there is an attempt made to swallow water it is thrown up. Slobbers run from the mouth. If it is a horse there will be a spasmodic twitching of the muscles of the neck when an attempt is made to swallow. There is great difficulty in breathing, which may increase and cause death. In cattle, one symptom often, but not always, shown is bloating. You may be able to feel the substance if it is lodged in the neck.

TREATMENT.—Endeavor to ascertain what the animal has swallowed, and where it is lodged. If it is lodged in the throat or neck, you may move it by rubbing it on the outside with

the hands. If in the throat, and you fail to move it by rubbing it up and down, place a clevis, or large ring, between the jaws, oil the hand, and try to reach and remove it with the hand. If these fail, and the choking is caused by a solid body, give a dose of oil or lard, oil being preferable. But if it is half-chewed food that is causing the trouble, oil should be given carefully if given at all. If all these attempts are futile, the only resort left is to use a probang—which is a long, flexible instrument with a bulb on the end; grease this well and start it down the throat, and, by carefully pressing against the substance, move it from its place, and so pass it into the stomach. The probang is not so successful if choking is caused by partly chewed food, and a pretty long wad is formed in the throat; for pressing against such a mass would only pack it into a shorter but larger plug, and thus make it more serious than before. If there is danger from excessive bloating, puncture, as directed for Hoven.

Hoven — Blown — Tympanites — Bloated, etc.—This is a distention of the stomach with gases.

CAUSES.—Sometimes it is caused by choking. It may result from chronic indigestion, or be a symptom of diseases of the liver, or parturient fever, but the most common causes are a change of food, or turning on wet clover pasture, or even turning on rank clover when dry. Potatoes, turnips, and apples, or their peelings (especially if fed when somewhat frozen), bran, shorts, etc., may cause it.

SYMPTOMS.—In many cases the symptoms are very alarming. The left flank will be swollen to a great extent, and tapping it with the fingers gives a drum-like sound. The breathing is quickened, because the gases press upon the lungs, and the pressure in this way may be so great as to cause the death of the animal. The nose sticks out, and sometimes the tongue hangs out of the mouth and the eyes are blood-shot. The animal may now stagger and fall and die, either from the interference with the action of the lungs from rupture of some of the intestines, or from absorption into the blood of some of the poisonous gases, and this fatal termination may follow in a few hours from the first symptoms.

TREATMENT.—This trouble should be treated as quickly as possible. Give

Carbonate of Ammonia,	. . . . .	6 drams.
Or—Aromatic Spirits of Ammonia,	. . . . .	3 ounces.
Or—Chloride of Lime,	. . . . .	4 drams.

Or even as much as an ounce of the lime in very bad cases. Give in cold water. But, perhaps, better than the above is

Turpentine,	. . . . .	3 ounces.
Linseed Oil,	. . . . .	1½ pints.

Give at one dose, and if the animal is costive

Take—Epsom Salts,	. . . . .	1½ pounds.
Water,	. . . . .	1 quart.

Mix, and give at one dose. But if the case is a very bad one, it should be punctured. Puncture on the left side, at an equal distance from the projections of the back-bone, the last rib, and the haunch-bone. This should be done with a trochar and canula, but in urgent cases a pocket-knife may be used. After puncturing, give a small dose of turpentine and oil.

Take—Turpentine,	. . . . .	1½ ounces.
Linseed Oil,	. . . . .	1 pint.

Mix, and give at one dose. Give the best of food, and give an ounce of gentian three times a day, for a few days.

Grain Sick.—Impaction of the rumen; or an overloaded stomach.

CAUSES.—Eating too much food, especially green food, or inferior food of any kind; eating green wheat is a frequent cause.

SYMPTOMS.—The back will be arched, the breathing hurried, the pulse quick, and the extremities cold. There will be a dullness, some pain, and if any dung be passed, it will be covered with slime—(mucus). The animal grunts or groans, and sometimes slobbers; will stand still, unless forced to move. The belly will be greatly swollen, and tapping it produces a dull sound, instead of the drum-like sound of tympanites; and by pressing the fingers against the swollen part, the prints of the fingers will remain in the part for some time; in this it also differs from tympanites.

TREATMENT—When first affected,

Take—Epsom Salts,	2 pounds.
Ginger,	$\frac{1}{2}$ ounce.
Water,	1 quart.

Mix, and give at one dose, and in about two hours after this,

Take—Carbonate of Ammonia,	4 drams.
Gentian, powdered,	8 drams.
Ginger, powdered,	4 drams.
Cold Water,	1 quart.

Mix, shake, and give at one dose, repeated every three hours as long as needed. If these fail, the stomach should be cut open and the contents removed with the hand; this should not be delayed too long, for many animals are lost in this disease by thus delaying. A description of this operation will not be given, as a surgeon should be called.

Diarrhœa.—CAUSES.—The same as in horses; also a cold in cattle often causes a catarrh of the bowels.

TREATMENT.—In almost all cases it is best to first give a slight physic.

Take—Epsom Salts,	8 ounces.
Gentian, powdered,	2 ounces.
Ginger,	1 ounce.
Water,	1 pint.

Mix, and give at one dose; and if the diarrhœa continues after this has acted,

Take—Tannin,	30 grains.
Gentian, powdered,	1 ounce.
Ale or Beer,	1 pint.

Or, flaxseed tea may be used instead of beer. Mix, and give at one dose, and repeat every three or four hours, until there are signs of recovery, and then be careful that you do not give too much medicine. In some mild cases the following will be found sufficient:

Take—Tincture of Rhubarb,	1 ounce.
Tincture of Cardamom,	1 ounce.
Bicarbonate of Soda,	1 ounce.
Brandy,	1 ounce.
Ale or Beer,	1 pint.

Mix, and give at one dose; repeat every three hours, until relief is afforded. But, in some cases, even stronger remedies are needed than either already given; then,

Take—Catechu, powdered,	6 drams.
Prepared Chalk,	6 drams.
Ginger, powdered,	6 drams.
Opium, powdered,	1½ drams.

These can be made into a paste with molasses and linseed-meal or flour, and placed well back on the tongue, and the animal thus compelled to swallow it. It is always best in diarrhoea to allow but a small amount of water. Do not keep it away from the animal so it will suffer with thirst, but allow only enough to prevent suffering.

Scours (White).—This is common among calves.

CAUSES.—It is usually caused by a change of milk, from that of the mother to that of a cow less fresh. Giving skimmed milk, or even the milk of the mother, may cause it, if it is deficient in quality.

SYMPTOMS.—The dung which the animal passes is softer than natural; is of a yellowish-white color, and some hard portions may be mixed with it. The little sufferer grinds its teeth, lies down, and looks at the sides.

TREATMENT.—If possible, ascertain what caused it, and remove the cause; and, if the calf is not greatly weakened,

Take—Flaxseed Oil,	1½ ounces.
Lime Water,	1½ ounces.

Give at one dose; or, if the calf is greatly weakened, give bicarbonate of soda, thirty grains; and if there is much pain, add to the soda thirty drops of laudanum. Give in water every one or two hours, until relief is obtained. Sometimes wheat-flour gruel will relieve it without medicine. If these do not afford relief, it may be necessary to give stronger remedies; yet great care should be exercised in giving strong medicines for diarrhoea.

Take—Catechu, powdered,	30 grains.
Prepared Chalk,	2 drams.
Milk,	4 ounces.

Mix, and give at one dose, and repeat every three hours, until relief is given. If the mother's milk is deficient in any way, change the mother's food accordingly, and so change the quality of the milk.

Enteritis—Inflammation of the Bowels.—CAUSES.—Exposure, poor food, too much food, etc.

SYMPTOMS.—Pressure on the bowels—especially in the right flank—causes pain; small quantities of dry, hard dung are frequently dropped; the temperature of the body is elevated, and sometimes the bowels are bloated. The animal desires to stand still, grunts, and grinds the teeth occasionally, and looks at the flanks. The nose is carried forward, the appetite gone, and the thirst is great. The pulse is quick, the breathing hurried, and if in the last stages of the disease, the mouth is cold, the eyes sunken, and the pulse almost gone.

TREATMENT.—Apply to the belly blankets wrung from hot water if the weather is suitable, but if the weather is too cold for this,

Take—Aqua Ammonia,	. . . . .	2 ounces.
Turpentine,	. . . . .	2 ounces.
Flaxseed Oil,	. . . . .	2 ounces.

Mix, and rub well over the belly and flanks, and cover with blankets; or,

Take—Mustard,	. . . . .	3 ounces.
Warm Water,	. . . . .	1 quart.

Mix, and apply as the above. Do not give a physic, although the bowels may be costive, but give injections of

Tincture of Opium,	. . . . .	2 ounces.
Warm Water,	. . . . .	1 quart.

Mix, and inject, and repeat in two or three hours. And if there is much fever,

Take—Fluid Extract of Belladonna,	. . . . .	2 drams.
Water,	. . . . .	2 ounces.
Or—Tincture of Opium,	. . . . .	3 ounces.
Water,	. . . . .	3 ounces.

Mix, and give either, at a single dose, every three hours until relieved. If there is excessive thirst, add to either of the

above one ounce of nitrate of potash. When the animal begins to improve,

Take—Tincture of Gentian,	2 ounces.
Ale or Beer,	1 pint.

Mix, and give three times a day for a few days.

Parturition.—This head includes foaling, calving, etc., as the remarks regarding the one are applicable to the other. The time the young is carried by the mother varies some from the general rule; sometimes as much as a month. When an animal becomes pregnant she becomes more docile in her disposition, thrives better, and, as a rule, ceases to desire the company of the male. But when it is very desirable to know surely whether an animal is with young or not, after a reasonable length of time has elapsed, put the hand into the anus, and the young can be felt. A mare that is with colt should not be put to very heavy work, especially to a cart or wagon; and in no case should she be forced to back violently.

SIGNS OF APPROACHING PARTURITION.—Milk is secreted; and in the mare there appears on the end of the teat a kind of whitish wax, after which the colt is seldom carried more than two or three days; often less than twenty-four hours, if all things are right regarding it. When the young is born it is best to tie the cord tightly about an inch from the belly, and cut it off about an inch below the string.

POSITIONS OF THE YOUNG IN THEIR PASSAGE FROM THE MOTHER.—The natural presentation is when the head is presented first, the lower jaw resting on the front part of the forelegs; and lest all is not right, examine all cases with the hand (as soon as the water bag can be seen) as far in as you can reach, having first oiled the arm well; or use the following:

Take—Carbolic Acid, pure,	$\frac{1}{2}$ dram.
Vaseline,	16 drams.

Mix thoroughly, and anoint the arm with it. This precaution will perhaps prevent your having a very sore arm from being in contact with the fluids. Some men are reported to have died from having been thus poisoned.

Sometimes the belly of the young is greatly enlarged with

dropsy, so that it is impossible for it to pass through the outlet, and the only thing that can be done is to let the water out. A long trochar and canula is the best instrument, but a pocket-knife may be used. Sometimes the head is enlarged by dropsy in the same way, and the same treatment is necessary. If in any case the pains begin before the time for the young to be delivered, give,

Laudanum,	2 ounces,
Or—Powdered Opium,	2 drams,

in tepid water, and repeat the dose every half hour, if necessary, until relieved. But if, after three or four doses have been given, the pains do not get better, smear the hand with fluid extract of belladonna, pass the hand in, and endeavor to get the fingers into the neck of the womb; not violently, but gently and gradually. And injecting the parts with pretty warm water will greatly assist you in this.

In some cases the neck of the womb has lost its elasticity, and will not stretch any more than the mouth of a tied meal-sack. In such a case the only remedy is to cut it at the upper part; but never be in any hurry about using the knife in such cases. This occurs at full time, as well as in the case stated above. Cutting is seldom successful in the mare, but is sometimes successful in the cow.

In some cases at full term the hind feet of the young are presented first. If its back lies to the back of the mother, and both feet are coming, it is not so very difficult; but if its belly lies to its mother's back, it will be very difficult, and no time should be lost in endeavoring to push it back and turn it with its back to the mother's back. To do this, put your hand in along the feet until you can reach the body, if possible, and, while some one pulls at the feet, try to turn it. But if you find it impossible to turn it, attach ropes to the hind legs, and pull on them only when the mother's pains are present, and pull up toward the mother's back, in order to raise the hips of the young over the bones of the mother. You may also assist in thus raising the hips by placing the hand inside, and when the ropes are being pulled endeavor to raise the hips.

Another, and more difficult presentation, is that in which the hips or hock joints can be felt, and the feet are doubled back under the young. If the hocks can be felt try to pass a rope under them, and, by pulling on the ropes and pushing against the body of the young, you may be able to straighten the legs; and then deliver as in the case already given in which the hind feet came first. The thing usually used for pushing a colt back is an iron made in the form of a fork, the ends of which are made large and rounded to prevent injuring the animals. But another convenient way, when the animal is lying down, is to remove your boot, roll up the pants, and insert the foot against the colt, and then pull, or have some one pull, on the ropes. If you fail in straightening the legs—as you likely will—then cut the legs off at the hocks, the best instrument for which is a chain saw; but as this will not likely be attainable on account of its being very expensive, a small saw, such as is used by carpenters for sawing in a circle, can be used by breaking the end off, and nicely rounding the broken end to prevent injury. When the legs are cut off get a hook in the thighs and get them straightened back into the passage, and then take it away. Care must be exercised in using hooks, or they will loose their hold and greatly injure or ruin the mother. If you fail in this, cut through the bones between the hind legs and endeavor to remove an entire hind leg, and then you may be able to take the young away.

Still another malpresentation is when the fore feet are in the passage, and the head doubled back over the shoulder. Pulling in such a case will do much harm, as it is impossible to deliver the young until its position is changed. Apply some cords or small ropes to the fetlocks, and then push the colt back into the cavity, and endeavor to straighten the head. If you can accomplish this, it is an easy matter in most cases to take the young away.

Sometimes one fore leg is presented, and the other back with the head; or the head may be thrown down between the fore legs; or the head protruding, and both legs thrown back along the belly. The treatment is the same as in other cases. If it can

not be straightened into position, cutting off some of the members is the last and only resort. But never cut a fore leg off at the knee. In all cases in which the last named treatment is necessary, give the mother powdered opium two drams, repeated as often as needed to relieve the pain; or to allow the animal to breathe chloroform, just sufficiently to deaden the feeling, gives great relief.

Another difficulty met with in such cases is when the back is presented, and if upon examination you find either the fore or hind parts nearer the outlet than the other, try to turn it, getting the legs already nearer the opening into the passage by pulling on them, and pushing back the other parts of the body. But failing in this, cut through the back, take out the intestines, and then remove the young in pieces.

Another malpresentation is when one or both fore and one or both hind legs are in the passage at the same time. First decide which way you can turn it most readily, and by pushing it back into the cavity straighten it, or in some way change its position. You might be led to think such a presentation was at hand, when, by examining, you would find twins instead; hence, the first thing to do, in all cases, is to examine thoroughly, as far as you can possibly reach; second, render such assistance as is necessary, and, third, persevere in your efforts.

Such cases as cited above are, perhaps, the most perplexing and discouraging of all; and nothing can be accomplished by becoming excited, and trying to be in a great hurry, and as suddenly becoming discouraged, and then abandoning the case. If the fluids which naturally surrounds the young have escaped, benefit can be obtained by injecting warm water or oil.

After all cases where force has been used, the mother should be kept warm, and kept from lying on the cold, wet ground. The parts that have been irritated should be bathed.

Take—Warm Water,	. . . . .	2 quarts.
Carbolic Acid (pure)	. . . . .	1 ounce.

Mix, and use as a bath, two or three times daily, and give her one dram of powdered opium every hour or two, as may be necessary to relieve the pain. Or, if she is depressed, give one

ounce of sweet spirits of niter, or four ounces of whisky, two or three times a day, as may be necessary, for a day or two, after which there is generally no danger.

Another trouble which sometimes occurs is the retaining of the membranes (cleaning, as it is often called). In such cases, force should not be too hastily employed, especially in a mare. If it should be in a cow, restrict the diet, and

Take—Epsom Salts,	. . . . .	4 ounces.
Gentian, powdered,	. . . . .	4 drams.
Ginger, powdered,	. . . . .	2 drams.
Water,	. . . . .	1 pint.

Mix, and give at one dose, and repeat the dose in three hours, and if it still does not come away, anoint the hands and arms with

Carbolic Acid,	. . . . .	1 dram,
Vaseline,	. . . . .	16 drams,

and get hold of the membranes with one hand and, with the other introduced into the womb, break away the attachments between them and the womb—which are many in the cow; one in the mare—and when it is removed, syringe the parts with water and carbolic acid, as already given.

Abortion.—Abortion among cows is one of the most disastrous things that can occur in a cattle community. It often occurs without any known cause, and from a few cases it spreads and goes through an entire community. Sometimes it appears to be an epizootic condition, or it sticks to a certain section of country, and just beyond a certain limit cattle are free from it.

CAUSES.—As has been said, it sometimes occurs without any cause being known, while in other cases a cause has been attributed. Certain kinds of grasses have been supposed to cause it; also bacteria, or parasites. Malaria may cause it in a cow (it does cause it in the human). It may be caused by smelling a dead animal, or eating over the graves of dead animals; by eating grasses, or other food, containing ergot; by eating frozen vegetables or drinking a draught of cold water; by kicking or pounding an animal, as is so often done; by eating any over-

stimulating food, poisonous herbs, or blasted grains of any description; by being over-exerted or frightened; by doing without food for a long time; by falling on the ice; or by smelling the product of an abortion. These products should always be burned, or buried where other pregnant cows can not possibly get to them. A cow that has once aborted, although seemingly all right, should not be allowed to remain with the herd when she again becomes pregnant.

As there is no treatment, the only thing that can be done is to prevent it. In order to do this, avoid all those things which tend to cause it; and, if there are any symptoms of abortion in any other animals, it would be best, if possible, to place each one that is pregnant in an apartment separate from all the others that are pregnant, and thus keep the endangered ones from coming in contact with each other.

Inversion of the Uterus.—This is commonly known as “coming down of the colt- or calf-bed.” It is frequently seen in the cow; sometimes in the mare, but in the mare it is seldom treated successfully.

SYMPTOMS.—A large, reddened, swollen mass is seen protruding from the vagina, to which the membranes (cleaning) may be attached. Inversion may either be partial or complete. If complete, in a cow, she soon lies down, and in this way it becomes very dirty.

TREATMENT.—Place a sheet or quilt under it, and, if the membranes are attached, carefully remove them; thoroughly cleanse every part of it in warm water; and then bathe with

Laudanum,	2 ounces.
Fluid Extract of Belladonna,	2 drams.
Warm Water,	8 ounces.

And, if the uterus is torn, stitch it up, and then, by gentle but continued pressure, replace it; and, if necessary, have two men assist you by holding it up with the sheet or quilt. Sometimes it is best to apply pressure to that part close to the animal's body, and sometimes best to press upon the part which is farthest away from the body, passing it in through the center of the opening. If you fail in one, try the other.

When you have succeeded in getting it inside, pass the arm well in and see that no folds are left in it. If you fail to reduce it in this way, place soft ropes around the hind legs, turn her on her back, and, by means of pulleys or other contrivance, raise the hind quarters up. This throws the intestines forward, and relieves you of their pressure. After it is replaced and properly adjusted, give three drams of powdered opium, to prevent her from straining and again forcing it out. If straining continues, despite the opium, take a large pin, raise the skin on the small of the back, fold it, pass the pin through the fold, and secure it in its place with a string, and leave it there until the straining ceases.

If the uterus has become gangrenous (mortified), the only resort is to give the animal chloroform, and then tie a cord around the uterus as close to its neck as possible; tie it very tightly, and then cut the outside portion away, and when the bleeding has stopped return the part left to its place. This might save a cow, but it is not likely it would save a mare. If the animal is weak, give stimulants.

Take—Sweet Spirits of Niter,	2 ounces.
Ale or Beer,	1 pint.

Or three or four ounces of whisky may be given, repeated every two or three hours, if necessary.

Parturient Apoplexy.—This is also called dropping after calving, and milk-fever. It is one of the most fatal diseases that afflicts cattle. It affects the brain and spinal cord, and sometimes the sympathetic nervous system. And the most noted characteristic of this disease is the rapidity of its development. An animal may appear to be in perfect health, be seized with this disease, and be dead in a few hours. It appears from the first to the third day after calving, does not follow an abortion, and does not occur in young animals, but generally attacks animals in their prime, and seldom attacks one in poor condition. It often follows cases in which the cow has not been able to calve without help, or when there has been great bleeding from the womb.

SYMPTOMS.—The milk fails in quantity, and but a small

amount of urine is passed; there is high fever; there may be but slight pain as yet, but soon more severe symptoms appear, the legs are moved in walking in a kind of paddling manner; she lies down, gets up, and lies down, until she is no longer able to rise; then she beats the head violently on the ground, and over the shoulder, or she may become very stupid, the sight of the eye enlarged, the breathing noisy, the pulse fifty or sixty beats per minute and almost imperceptible, and the animal shows but little sense of feeling. Death soon relieves such severe cases. But when the disease does not run so violent a course the same symptoms occur, but not in such rapid succession, and when they occur as last stated the case may be treated.

TREATMENT.—Before the cow gets down, if the pulse is strong, take from four to six quarts of blood from the jugular vein; but if the animal is in any way weakened (as from too much bleeding, etc.,) or stupid, do not bleed at all, but give physic in all cases.

Take—Epsom Salts,	1½ pounds.
Water,	3 pints.

Dissolve the salts in the water and give at one dose; but when blood has been taken do not give so much physic. Give injections of warm soap-suds freely. Bed her well and turn her frequently.

If she becomes very stupid, pour cold water on her head; and while in this stupid state, great care should be exercised in giving medicines, for the medicine is liable to pass into the wind-pipe and cause strangling. Before the stupor comes on give bromide of potassium in one and one-half ounce doses every three hours in cold water. If in twelve or twenty-four hours there appear to be signs of recovery, allow but little food for a day or two. If there are symptoms of paralysis, give powdered nux vomica, one dram three times a day in the feed, or any way more convenient. This disease is more easily prevented than cured, and a cow which has been once attacked is more liable to another attack.

If in any case an animal is suspected as liable to this dis-

ease, she should be fed sparingly and given one pound of epsom salts in a quart of water before calving. And after calving, as well as before, the diet should be restricted; she should not even be allowed to run upon luxuriant pasture for a few days.

Parturient Paralysis.—This attacks cows about the third day after calving. It is not so serious as parturient apoplexy.

SYMPTOMS.—Loss of power is the principal symptom. There will also be a kind of paddling action when she walks; and if she falls or lies down she can not get up; the amount of milk will be decreased, and if you stick her hind legs with a pin you can see that she can feel but can not move.

TREATMENT.—Give but little food for a day or two, and give one pound of epsom salts in water, and stimulate the loins with the ammoniacal liniment (see Index), or

Take—Mustard, powdered,	2 ounces.
Hot Water,	1 quart.

Mix and rub over the loins. Another, an old and perhaps a good way to stimulate the loins is to place a wet blanket over the loins, and rub a hot smoothing-iron over the parts, not hot enough to scald, but to make the parts quite warm. If it does not get better for several days use an electric battery; and if she knuckles at the fetlock joints for some time, give two drams of nux vomica, twice a day, in the feed. Give it for several days, or until she is relieved.

Parturient Fever—Milk Fever.—Almost any case of parturition produces some fever, but does not in all cases produce trouble.

SYMPTOMS.—A slight increase of temperature and a quickened pulse. The bag is tender and slightly swollen; the swelling in some cases extends along the belly, sometimes even up to the fore legs. The mouth will be hot, and the breathing slightly quickened, but as soon as the milk is properly secreted no further trouble need be apprehended. And although this is a simple trouble, medicines are sometimes needed. These symptoms are sometimes the first symptoms of parturient apoplexy.

TREATMENT.—Regulate the diet; give but little food for a day

or two, and what is given should be of the best quality, and such as can be easily digested. And,

Take—Epsom Salts,	8 ounces.
Saltpeter,	1 ounce.
Water,	1 quart.

Mix. Give at one dose, and continue giving saltpeter, in half-ounce doses, three times a day for one or two days. If the bag is swollen and hard, bathe it with hot water for an hour three times a day, at the same time rubbing it well with the hands, and anoint it frequently with

Oxide of Zinc,	1 ounce,
Lard,	5 ounces,

Mixed thoroughly. If the bag remains swollen and hard for several days, give four drams of iodide of potassium three times a day, and anoint the bag once a day with the following:

Take—Iodide of Potash,	3 drams.
Iodine Crystals,	6 drams.
Water,	1 pint.

Mix, and shake occasionally until dissolved, and it is ready for use.

Mammitis—Also, Inflammation of the Bag, Caked Bag, Garget, etc.—This usually occurs in a milch cow, but it may occur in a heifer.

CAUSES.—Irregular milking; changes of the weather; exposure to wet and cold; and injuries to the bag. It may involve one or more teats or the entire bag.

SYMPTOMS.—The bag will be hard, hot, and painful, and there will be some general fever. Both the breathing and pulse will be quickened, the appetite poor or entirely gone; the cud is no longer chewed, and the milk fails in quantity or dries up entirely. The fever will, in most cases, produce costiveness, yet there may be diarrhoea in rare cases. If the inflammation is deep-seated, there is a tendency for the bag to remain hard, and in this way destroy the secretion of milk.

TREATMENT.—Prevention is better than treatment. To prevent it, milk the cow or heifer for a few days before calving, if the bag is full of milk, and never at any time allow the bag to

become distended with milk. If the above precautions are observed garget will seldom be seen; but when it does occur treatment becomes necessary. Bathe the bag with water just as hot as the animal will allow without burning her. Bathing should be kept up for at least an hour three times a day. If this can not be done, take a piece of muslin about four yards long, and tear both ends lengthwise in the center, leaving enough untorn in the middle of the piece to cover the entire bag; then tie the two sides of one torn end around the body, just in front of the bag; draw the other end back between the hind legs, and tie the two parts to the part already around her body; and if the teats are much swollen and stiffened, cut holes for them to stick through, then fill the sack thus formed below the bag with any good poultice. Hops boiled up with a little bran or linseed meal make an excellent poultice. From their lightness and their capacity for retaining moisture, they are perhaps as good as any thing. If the weather is too cold to allow of either bathing or poulticing, this pouch should be stuffed with wool or tow, being first heated by a fire, which keeps the bag warm and is a great relief. Milk her often, or, better still, draw the milk with a milk-tube; this is a small tube with the end rounded and smoothed, holes being made in the sides to admit the milk. And frequently anoint the bag with

Fluid Extract of Belladonna,	. . . . .	1 ounce.
Lard,	. . . . .	8 ounces.

And give,

Sulphate of Magnesia,	. . . . .	16 ounces.
Aloes, powdered,	. . . . .	4 drams.

Mix in warm water, and give at one dose. If in six or eight days the bag becomes hardened, rub it over with tincture of iodine, and give iodide of potash, four drams, twice a day. If pus forms near the skin open and let it out. If mortification of the part occurs, the mortified part will either have to be cut off or allowed to fall off. It often falls out, after which the animal usually does well.

Texas Fever.—Also called *Mexican fever*, *Spanish fever*, *Splenic fever*, etc.—This disease is a variety of anthrax, being

essentially the same in its nature, differing only in some of its symptoms and in the manner of its attack. It is of the nature of anthrax, yet it can be, and is, influenced by malarial poisons, and is something akin to the yellow fever of man, and yet it is not the same. It also very slightly resembles rinderpest.

It is spread by contagious influences. Texas cattle carry and spread the poison in the road and pastures wherever they go. The period which elapses from the time of exposure to the disease and the time of taking it varies from two to five weeks. Those that are slow in taking it, have it less violently, and *vice versa*. A diseased animal may carry the contagion without itself being much affected. An affected Northern animal can not convey the poison or contagion to another native animal. Infected animals, when taken North, lose the disease after a few frosts in the fall; cold stops it.

An examination after death shows the spleen to be enlarged and disorganized; the mucous lining of the intestines softened and greenish in color, which indicates mortification. The intestines will be ulcerated, as in typhoid fever in man.

SYMPTOMS.—The first symptoms noticeable will be a rise in the heat of the body; the temperature will be 103° or 107° F. Then the animal becomes dull, its back will be arched, its ears hot, and its appetite lost. The cud is no longer chewed; the eyes become glassy; the muscles jerk, and the urine will be dark colored—black or bloody—to which if nitric acid be added it will become cloudy. The dung will be dry and bloody. The animal dies in stupor or convulsions. Northern cattle taken South are very liable to have this disease, and very seldom survive an attack.

TREATMENT.—Keep all diseased animals away from healthy ones; keep them warm and dry, for an animal so affected can not withstand even a severe frost, and should be warmly stabled and bedded.

Take—Chlorate of Potash,	. . . . .	½ ounce.
Tincture of the Chloride of Iron,	. . . . .	1 ounce.
Water,	. . . . .	1 quart.

Mix, and give at one dose three times a day. If the animal begins to show weakness, give tincture of cinchona, four ounces, every one or two hours.

Or take—Whisky, 4 ounces.
Quinine, 35 grains.

Mix, and give as one dose every two or three hours; give the greatest care to the comfort of the patient.

If an animal dies with this disease, it should be buried deep—or better, burned—and if the animal is to be skinned or otherwise handled after death, the greatest caution should be used to prevent any cuts or scratches on the hands, and if any such injuries exist, the animal should not be handled, especially if it is already partly rotten—and there seems to be a partial decomposing action going on at, or even in some cases before, death. If the poisons thus being formed, or those already existing, are absorbed in any way, they may cause the loss of a hand or arm, or even life. I would advise against saving the skin when the cause of death is unknown.

Mange.—The causes and symptoms are the same as in the horse.

TREATMENT.—This is also the same, yet dirty remedies may be used on cattle which could not be used on horses. A good remedy for cattle is,

Take—Sulphuret of Potassium, 1 ounce.
Water, 10 ounces.

Or take—Turpentine, 2 ounces.
Oil of Tar, 2 ounces.
Train Oil, 2 ounces.

Mix, and apply once or twice a day as directed for mange in horses, which see.

Wounds.—The different varieties of wounds commonly seen are: Incised, lacerated, punctured, and contused. An incised wound is a clean cut; a punctured, is done with a small instrument, and the injury is deep; a lacerated, is torn, and in a contused wound the flesh is injured, and the skin not broken.

TREATMENT.—If the wound is severe, and the animal is healthy and in good flesh, and it is a horse,

Take—Aloes,	6 drams.
Ginger,	1 dram.
Opium, powdered	$\frac{1}{2}$ dram.

Mix in hot water, and give at one dose when cool. But if it is a cow,

Take—Epsom Salts,	8 ounces.
Water,	2 pints.

Mix, and give at one dose.

If the bleeding is very great, the dose just given should be withheld. If there is severe bleeding, open up the wound as well as possible until you can see just where the blood comes from, and grasp the vessel with a pair of forceps, give it a twist or two to stop the flow of blood, then tie it tightly above the forceps, leaving the ends of the threads long enough to hang out over the edge of the wound (silk thread is, perhaps, the best). If you can not so tie the vessels, applying a bandage so it will press upon the vessels may arrest the bleeding. If this will not stop it, pack the wound with lint or tow, and then bandage. The lint or tow may be wet with

Sugar of Lead,	2 ounces.
Water,	1 pint.

Or tincture of the chloride of iron may be used instead of the above in a very bad case.

In some mild cases of bleeding, warm or cold water applied to the part may arrest it. Having succeeded in arresting the bleeding, if by tying the artery, thoroughly cleanse the wound with water, and then bring the edges of the wound together, keeping them together with stitches, taking the stitches so a pretty wide piece of skin will be caught, and tie each stitch separately. And in tying, tie as an ordinary knot, then put the end under the string just as before. This makes a single knot with a double twist in the string; then draw the knot tight and tie another knot on top of this, and the knots will not slip. If the wound is a large, gaping one, which stitches will not hold,

leave the thread in the needle, so it will pass through the skin on both sides of the wound double; cut the thread off close to the needle, take another stitch in the same way until as many are taken as necessary, always leaving the threads long so they will not be pulled out. When all the stitches are thus taken, take two quills or limber pieces of wood and place one between the two threads of one stitch, and tie the two ends over the stick; proceed in the same way with all the stitches on that side, then place the other stick or quill on the other side of the wound and tie the stitches in the same way, drawing each one as tightly as necessary to bring the two edges of the wound close together.

Sometimes strips of strong cloth, with their edges dipped in warm Burgundy pitch, can be fastened along the sides of the wound, far enough back so that their edges, left loose, can be sewed together, and thus bring the edges of the wound together. (If in any case the intestines are cut through and need sewing, use a cat-gut suture—small fiddle-string—and in sewing turn the cut edges inside of the gut, so the string so used may fall into the inside of the gut and be passed out.) And bathe well with warm or cold water. If one is tried and does not afford relief try the opposite, and then use that which seems to give the greatest amount of relief. Never apply any turpentine or black oil to a wound. It is very rare that any oil does not do harm. The white lotion or the carbolic acid lotion (see Index) are perhaps the best. If unhealthy granulations—proud flesh—spring up,

Take—Nitrate of Silver,	. . . . .	20 grains.
Water,	. . . . .	1 ounce.

Mix, and apply with a small brush. If this does not arrest it, rub the parts with a stick of nitrate of silver, holding it in a quill or piece of paper to protect the fingers; or take an ounce of water, and put into it all the blue vitriol it will dissolve; or try

Carbolic Acid, pure,	. . . . .	$\frac{1}{2}$ dram.
Water,	. . . . .	1 ounce.

Apply any of these once a day, or oftener, if necessary. If

none of these will answer, use nitric acid and water, equal parts at first, gradually using more acid and less water until it does do the work. After the proud flesh is subdued, treat as an ordinary wound.

Fractures.—This means broken bones; and such accidents are very common in all domestic animals. There are several varieties of fractures, as simple, compound, comminuted, and complicated. A simple fracture is one in which the bone alone is broken, the muscles and skin not being cut through. A compound is one in which the bone is broken, and the muscles and skin at the same time cut through. A comminuted is one in which the bone is shattered to pieces. A complicated is one in which there is some large vessel, nerve, or joint injured, as well as a bone broken.

The bones of the lower animals will unite quite as readily as those of man if the broken ends can be kept still, and in their proper position.

Fractures also receive distinctive names from the manner in which the bones are broken, as transverse, in which the bone is broken square across; oblique, in which the bone is broken across in an oblique angle; longitudinal, in which the bone is split, as it were. The first named is the most easily treated successfully; the second is very difficult to treat, as the ends of the bones tend to pass each other; and the last is usually most difficult to treat with entire success, for it usually extends into a joint, and in this way causes a stiffening of the joint.

Fractures generally occur from some injury, but they may occur from very severe muscular exertion, as sometimes occurs in throwing an animal. Sometimes a bone is fractured and still retains its position, and it may or may not be displaced after the injury.

SYMPTOMS.—Sometimes the ends of the bone pass each other, or penetrate the tissues, until the trouble is very apparent to any beholder. But when these signs are absent, a kind of grating sensation can often be felt by placing the fingers on the parts, and then moving the limb; or, by placing the ear to the parts this grating noise can be heard, when the limb is

moved. But when the bones are not displaced, it is difficult to determine the trouble. It now becomes necessary to notice the animal's action, and ascertain whether he became lame very suddenly, and also whether any injury, slip, or fall was sustained about the time the lameness occurred.

TREATMENT OF A SIMPLE FRACTURE.—Space only permits some general principles of treatment here. Compound fractures above the knee or hock-joint can not often be successfully treated, in the larger animals; but when below the knee or hock, success may crown an effort. Always get the ends of the bones in place as soon as possible, and keep them in place, by means of a starch, plaster-of-paris, or tripiloth bandage, or by means of leather or light splints. There is also a kind of felt bandage, or splint, now prepared, which is excellent.

In preparing a bandage, take narrow strips of muslin about three yards long, and if starch is selected, have it properly prepared by boiling it until it is about as thick as very thick cream; or, if plaster-of-paris, or tripiloth, is selected, have it mixed with cold water until it is about as thick as thick cream. Either of the last should be mixed in small quantities at a time, in any old vessel. Mix the strips of muslin through this until every part of them is thoroughly saturated with the mixture; then begin at one end of a strip and roll it up nicely, making a convenient roll for handling.

When every thing is thus prepared, and the fracture properly placed, wrap the leg with a thin layer of cotton-batting and then bandage the leg loosely with flannel, and apply the flannel bandage to the leg—from the foot just as high as possible. Then level all hollows on the leg with cotton-batting, and if a starch bandage is used, all that is necessary is to thoroughly and tightly wrap the broken part with the starched cloth, never allowing it to extend beyond the flannel bandage. The bandage should be applied in several successive layers, applied in different directions, and the leg kept as still as possible until the starch becomes hard.

The same directions should be followed in using either plaster-of-paris or tripiloth, with the additional directions that,

after applying a layer of bandage, some of the mixture should be rubbed over this before another layer is applied, and so on; always keeping the leg as nearly still as possible until the bandage sets. If the felt bandage (which must be bought of a druggist) is used, all that needs to be done with it is to soak it in hot water until it gets soft, and apply it while it is hot, pressing and fitting it to the leg, and then applying a muslin bandage over it, to keep it to its place.

The bones of young animals unite much better than those of old ones. The bandage should be kept on the leg for two or three months, or even longer if the bones do not unite readily.

Slings were, and are still, used by many surgeons; but lately some recommend bandaging the leg, and turning the animal loose in pasture, or in a large stall or shed, as must be done with a cow or colt.

If the fracture is a compound one, it becomes more serious, but even then treatment is often successful. First replace the bones; and to accomplish this it often becomes necessary to make the flesh-wound larger by cutting near the bones with a knife. When the bones are replaced, the edges of the wound should be brought together and kept together, adhesive plasters, in this case, being better than stitches. Cleanse the wound thoroughly with the carbolic lotion (see Index), and apply splints or bandages, as already recommended, leaving an opening in the bandage over the torn flesh, so the wound can be kept clean and frequently dressed with the carbolic lotion, to keep the matter washed away. Further than this, the treatment is the same as in simple fractures. In almost all cases, especially if in a strong, healthy animal, from five to eight drams of aloes should be dissolved in hot water and given as a drench, when cool, and but a small amount of food should be allowed for two or three days.

These directions are applicable to all animals, except that slings are seldom used for cattle; and in cattle, when the fracture does not unite, the limb may be amputated, and the animal fattened for the butcher. Amputation has been performed also

in valuable stallions or brood mares. Both cattle and horses have been so treated, and have afterward walked about on wooden legs.

Rheumatism is a disease of the blood, and usually affects the joints.

SYMPTOMS.—The affected joint will be hot, painful, tender, stiff, and sometimes swollen; the animal suffers much, and does not want to move; the inflammation often moves from one joint to another; the skin is dry, caused by the fever which is always present in this disease; the fever also often causing the animal, if a milch cow, to quit chewing the cud; the pulse will be quickened, and the bowels costive. Milch cows are most liable to this disease, and they are most liable in the spring and fall.

TREATMENT.—For a cow :

Take—Rochelle Salts,	12 ounces.
Ginger,	3 drams.
Water,	1 quart.

Mix, and give at one dose, and continue giving three or four ounces of Rochelle salts, every morning before feeding, until the bowels begin to act. If it is a horse,

Take—Aloes, powdered,	6 drams.
Ginger,	2 drams.

Mix in hot water, and give when cool. Place the animal in a dry, warm place, and bathe the parts with

Tincture of Opium,	2 ounces.
Chloroform,	2 ounces.
Water,	12 ounces.

Bathe two or three times a day, and, after each bathing, bandage the leg loosely with flannel, and give salicylate of soda, two drams every two or three hours, as long as needed; when the more acute inflammation has passed bathe the joint with

Turpentine,	4 ounces,
Flaxseed Oil,	4 ounces,

two or three times a day.

Bathing.—For this, water is most frequently used; but vinegar and salt, and many other things are used. It is impos-

sible to say just what particular cases should have heat applied, and what should have cold applied, for if in any case either is tried, and it does not seem to do any good, after thoroughly trying it, the other should be tried, and then continue using whichever seems to do the greatest good, and never use either if you are satisfied that it increases the pain.

As a general rule, warmth should be used for lymphangitis, strains, bruises, laminitis, etc., when there is great pain. Use it as hot as it can be borne by your hands, while for inflammation of the bowels, pleurisy, lung-fever, etc., it should be applied still hotter.

When hot bathing is to be used it must be constantly applied for hours, for if it is stopped the drying up of the water on the parts cools it; and thus bathing, for a short time, at short intervals, with warm water, is about the same as if cold were used. If warm water has been used for several hours, and it becomes necessary to stop it, the part should be wiped dry and bandaged, or blanketed, to prevent a reaction from the evaporation of the remaining fluids, and consequent cooling of the parts.

There are different ways of applying baths to animals. They can be applied directly with a sponge or syringe; or the part may be bandaged or blanketed, and the fluid poured upon these; or cloths or blankets may be wrung from hot water, and applied to the part and immediately covered with dry blankets, and these covered with an oiled cloth to prevent the heat from escaping. An excellent way to apply heat to the leg where it can not be bandaged is to make a soft hay rope, and begin at the foot and loosely wrap the leg with this, secure the end and pour warm water upon this. When the hay is removed, the leg must be well wiped, and in some way wrapped in cloths until thoroughly dry.

When it is thought best to use cold instead of heat, a thin bandage or blanket should be applied, and kept constantly wet with cold water. This is much better than a heavy roll of cloths. When foul, stinking sores are to be cleansed, luke-warm water should be used, applied with a syringe or by means of old cloths. If cloths are used, they must be thrown away as soon as used,

for they will become foul and poisonous. Sponges should not in these cases be used and kept for subsequent cleansings. For special treatment of such sores, see Abscesses.

Doses for Young Animals.—There can be no definite rule given which will answer all cases, as the size and flesh of the animal will vary the dose to some extent, as will also the disease from which an animal is suffering. And as there can be no rule laid down, I will just give a series of fractions which will approximately indicate the doses for young colts, or calves, from the age of one to twelve months. The figures above the lines show the age of the animal in months; and the figures below the lines, taken with those above the lines, in the form of a fraction indicate the amount of medicine which should be given, as compared with the full dose for an ordinary sized animal. The figures are as follows:

AGE.....	1	2	3	4	5	6	7	8	9	10	11	12
Dose.....	$\frac{1}{20}$	$\frac{2}{30}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{7}{36}$	$\frac{8}{36}$	$\frac{9}{36}$	$\frac{10}{36}$	$\frac{11}{36}$	$\frac{12}{36}$

For example, take the figures in the list $\frac{1}{20}$: the figure 1 indicates that the animal is one month old, and $\frac{1}{20}$, taken as a fraction, shows that one-twentieth part of the full dose for an ordinary sized animal should be given. Again, take $\frac{3}{36}$; this shows that the animal is three months old, and that three thirty-sixths—one-twelfth—of a full dose should be given; and so on. From the above it will be seen that at one year old the animal takes one-third of the full dose; then at two years one-half; at three years three-fourths; and at four years old the full dose.

Condition Powders.—There are a great many kinds of powders put up and for sale, some good, others harmless, and others injurious. The majority of the so-called condition powders are made and used for their tonic properties, but some contain sulphide of antimony—black antimony. I will only give a quotation from “Finley Dun’s Veterinary Medicine” regarding the use of antimony. He says: “Being uncertain, irregular, and often violent remedies, the antimony sulphides are not now used in human medicine, and should be discarded from veterinary practice.”

The following formula is a very good one for animals that are run down, weakened, or debilitated :

Take—Bicarbonate of Soda,	2 ounces.
Fennigreek,	4 ounces.
Gentian,	4 ounces.
Ginger,	2 ounces.
Rhubarb,	2 ounces.
Sulphate of Iron,	2 ounces.

Powder, and mix. Make into twelve powders, and give a powder three times a day. If the bowels are costive, give with each powder a half pound or a pound of oil-cake meal, until the bowels begin to act as desired. If the amount of water passed is scanty, two or three ounces of saltpeter may be added when making the powders. If the lining membranes of the nose, mouth, eyes, etc., are of a pale or white color, add two ounces of the saccharated carbonate of iron to the powders when made. If these lining membranes are yellowish in color, use twice the amount of rhubarb given in the formula.

If the skin is scurfy, rough, and dirty, and the animal scratches, or if there is a tendency to soreness of the skin, add thirty grains of arsenic to the powders. And when arsenic is added, the mixing must be very thorough, in order that some of the powders may not contain too much arsenic. And if at any time the food in which the powder is given is not eaten, the trough must be cleaned, lest in this way two doses be taken at once. When the powders contain arsenic, they should be placed where no animals or children can get at them. Some animals will eat enough of these powders to cause trouble ; but if given as directed they are harmless, and of great value.

White Lotion.—This lotion is extensively used by professional veterinarians for sores in which the surface of the skin is broken or cut in any way, and more especially in old ulcers or sores from which there is a profuse discharge of pus. It is prepared as follows :

Take—Sulphate of Zinc,	6 drams.
Sugar of Lead,	1 ounce.
Water,	1 quart.

Mix until dissolved, and when it settles pour off the clear

part, leaving the sediment, or filter through filter paper, or just strain it through a good, heavy piece of muslin. In some very bad sores it may occasionally be applied stronger than this—even twice as strong in rare cases.

Carbolic Lotion. This lotion is more extensively used than the white lotion for an antiseptic, and hence is almost always used during and soon after a surgical operation or after a fresh wound. It is also used for the same purposes as the white lotion, but it has not the property of drying up discharges from sores that the white lotion has. The carbolic lotion is made as follows:

Take—Carbolic Acid, pure,	1 dram.
Water,	5 ounces.

Mix well and filter. This, like the white lotion, can in some cases, as in old sores where there is a very stinking discharge, be used stronger than as given in the formula. Carbolic acid is one of the best of medicines to destroy bad smells about old sores, and for this purpose may be used on poultices, etc.

Ammoniacal Liniment.—This liniment is extensively used as a stimulant or counter-irritant in sore throat, bronchitis, rheumatism, and chronic joint diseases. It is made of

Aqua Ammonia,	2 ounces.
Turpentine,	2 ounces.
Flaxseed Oil,	2 ounces.

Or any oil may be used instead of the flaxseed oil. Mix, shake well, and it is ready for use. When made by this formula it will blister some horses, while others are not at all affected. Hence its strength must be varied by using more or less oil to meet such cases as are spoken of under "Blistering."

Black-leg—Quarter-ill—Black-quarter.—This disease usually attacks young cattle under two years old, and often proves suddenly fatal. This disease, and also its treatment, are essentially the same as Texas Fever, the only difference being in the manifestation of the symptoms and its only attacking young animals. The treatment of either is considered a preventive to a certain extent. See Texas Fever, page 918.

CHAPTER XIV.

SWINE AND THEIR MANAGEMENT.

IN the early history of farming west of the Alleghanies the hog was the most important product of the farm; and, indeed, about the only one the farmer could depend on to furnish "cash in a lump" to meet payments on land and the yearly bills. Not only were we without railroads, but, with the exception of "the National Road," turnpikes were unknown, and wagoning grain to a distant market over mud roads, to be sold at a low price, was a slow way to raise money. I remember a neighbor who lived forty-five miles from Cincinnati spent ten days with a four-horse team in taking thirty-five bushels of wheat to market, and sold it for three "levies" (thirty-seven and a half cents) per bushel. Corn often sold at ten to fifteen cents, and oats at eight to twelve a bushel; and I remember, between 1840 and 1850, that my father bought yearling calves at one dollar per head, and good cows at eight to ten dollars each.

Pork, at that time, although occasionally very low, brought a better average price than any other farm-product, and during the packing season was always in demand for cash, and so it came to pass that nearly the entire business of the country turned on the price of pork, for all business was done on credit, and if pork brought a good price the country was safe for a year.

There was no difficulty in raising hogs or in getting them to market in those days, for "hog cholera" had never been heard of, and the swine had strong constitutions, and could make an independent living a good part of the year. They had also excellent locomotive powers, and could with ease transport their

own carcasses to a market from fifty to one hundred miles distant. Food also was cheap and abundant. Our virgin soil produced abundant crops of corn with little labor, and in the boundless forests were roots and mast, on which, in favorable Winters, the hogs would thrive for months without other food.

Hogs were seldom confined, even in a field on the farm, but were turned out on "the range," each farmer having an earmark—duly recorded at the county-seat—by which he could tell his hogs if they strayed to a neighbor's. Hogs have such strong local attachments, however, that if fed occasionally they would rarely get separated from the herd. The calling of hogs was quite an artistic performance, and in a still morning a farmer with strong lungs could call his herd, though they might be a mile away. There was a musical cadence to the "Pig-oo-ee" as it was long drawn out with a strong accent and a quaver on the "ee." The hogs would recognize the voice of their owner, and the first one that caught the faintest sound would raise its head and listen, and as soon as assured that it was the voice of its owner it would sound a note of warning which all understood, and the herd would start pell mell for home, and their speed would not slacken until the feeding-lot was reached. The hogs had another note of mingled defiance and alarm which, if sounded, would at once rally the herd at any point for defence, and they would charge in a body with bristles erect and mouths open, the very incarnation of fury. If one wanted to catch a pig in those days he must first take his bearings and select a place in the fence that he could easily scale, and then make a run for it as the professional base ball player does for his base, and often he was glad to drop the pig before he could reach a place of safety. I remember often driving up a sow from the woods with her young litter when she would walk backwards and fight every inch of the way, and every few rods charge on me so that I must beat a retreat.

The hogs of that early day were of no particular breed, or were rather a mixture of all the breeds that had been brought across the mountains by the pioneer settlers. The only hogs I remember that resembled any of the present day were the

Berkshires (which could occasionally be found with all the characteristics of the pure breed), and the Essex; and in my judgment many of the best qualities of some of our modern breeds can be traced back to these breeds, and particularly to the Berkshire.

Hogs were of all colors, from jet black to pure white, with all varieties of spots, with many red, and some blue and fawn color. The difficulties in the way of improving the breeds, or of keeping a breed pure, were well-nigh insurmountable. To begin with, there was no way of transporting hogs from the East except by wagon or on foot. There were few breeders who had improved hogs for sale, and fewer agricultural papers to advertise them in. Postage on a single letter, till later than 1840, was twenty-five cents; and it will be readily seen that few farmers could afford to import breeding stock. There was still another obstacle, which was the difficulty of keeping the stock pure; for the woods were full of boars, many of them old, tough fellows, with a snout equal to a steam-shovel and the muscular activity of a cat, and if a sow was in heat they would find her, and no ordinary fence would keep them from her. Besides, the hogs the farmers had suited them very well. Corn was so cheap that it made but little difference whether it took a few bushels more or less to fatten the hog, and it was doubtful whether a new breed could winter on mast, fatten by "hogging down" a half-acre of corn, and then walk to market; and so there seemed little call for improvement, and few efforts were made in that direction.

With the advent of the railroads to transport the hog to market there came a demand for a better breed of hogs; and the present generation has seen many changes in all that pertains to the management of the hog and its products. Now our hogs are bred with so small bone, and such a tendency to develop fat, that they are usually wagoned the mile or two necessary to reach the station from which they are shipped. The packing season does not depend on cold weather, but extends—by the use of ice—through the year. The farmer does not wait till winter, and then drive to a distant city; but there is a cash

market at his door every day in the year for all the hogs he can produce.

Recent statistics show over thirty-six millions of hogs in the United States, with an aggregate value of more than one hundred and seventy millions of dollars. The highest average value of hogs is usually found among the truck or dairy farmers, who keep but few, and the lowest in the newer States, or where there has been little improvement in farming. In 1876, when Coburn wrote his work on "Swine Husbandry," he found the highest average value per head in Massachusetts, \$18.03, and the lowest in Arkansas, \$3.31. Nine States at that time produced about two-thirds of all the hogs in the country; viz., Iowa, Illinois, Indiana, Missouri, Kentucky, Ohio, Georgia, Tennessee, and Pennsylvania. The highest average value in these States was in Pennsylvania, \$11.50 each, and the lowest in Georgia, \$3.91 each.

In 1877, which was a year of low prices, I examined the assessors' returns in my own State (Ohio), to see whether in the counties that had paid most attention to the improvement of hogs they were valued higher for purposes of taxation. I found the entire number of hogs to exceed two millions, with an average assessed value of \$3.77 per head. In five counties—viz., Warren, Butler, Lake, Clarke, and Ross—the average value was over \$5.50 per head, or \$1.75 per head more than the average for the entire State. These, with the exception of Lake, are among the largest hog-producing counties in the State, the four averaging over forty thousand each. Lake County reported only three thousand hogs, and the high value given them is due to the fact that they were kept up and fed largely on slop, as milk and potatoes are the principal products of this county. The other counties named are noted for their improved hogs, and Warren and Butler, especially, as having originated the Poland China. The lowest valuation in the State was in Wood County, and was \$1.43 per head.

Notwithstanding the ravages of hog cholera, the production of pork has shown a steady increase in this country, as will be seen by an examination of the following table:

The statistics for the five years ending with 1881 are as follows :

NUMBER OF HOGS PACKED IN THE UNITED STATES.

1877,	10,265,413	1880,	14,896,245
1878,	12,062,236	1881,	16,357,360
1879,	14,480,703		

During these years a little over one-third of the hogs were summer packed.

There has been a steady increase of exports of the hog product, and in 1880 it reached over eighty-five millions of dollars.

Who should raise Hogs?—There can be no question as to the profit of a few hogs on every farm. They will consume the waste of the dairy and kitchen, follow the cattle in the barn-yard in winter, eat the weeds from the garden, as well as the small potatoes and other unmarketable products, and furnish at a small outlay quite an amount of lard and meat, which may be consumed in the family, or will always bring cash in the market. The man on a rolling farm, or one which for any reason is not well adapted to corn, should remember, however, that he can not successfully compete with the one who has rich bottoms, or black, loamy land; and for one thus situated to make the production of pork his leading interest is to injure his farm and lead to disappointment and loss. The farmer may keep a few hogs at a profit, confining them to the piggery and a small lot; but if he gives them the range of his farm, and must on this account make all his fences hog proof, the extra expense from this cause alone will often exceed the profit.

Improvement of Stock.—The matter of improving hogs is at present very easy, and not expensive. We have many excellent breeds from which to choose; and in many parts of the country what is known as common stock is really so much improved that all that will be necessary to still further improve it, so as to have a pork hog of great excellence, is to use thorough-bred boars, and by this means grade up to the desired point of excellence.

In fact, I do not consider it a part of the ordinary farmer's

business to raise thorough-bred hogs. For to do so successfully requires more time and skill than he can command, and for the purpose for which he produces the hog, namely, for the butcher, I believe a good high grade is better than the thorough-bred. So I would advise the farmer who produces hogs for the butcher to procure a pedigreed boar of the stock best suited to his purpose, and cross on sows selected from his own herd. As choice pedigreed pigs from three to five months old can be bought for from ten to thirty dollars each, and one can serve quite a number of sows (often being sufficient for two adjoining farmers), and will then in many cases sell when fattened for enough to pay for the original outlay, it will be seen that no one should be deterred by the expense from attempting to improve his stock of hogs. I think that there are many farmers who, by a single cross, could add two or three dollars per head to the value of their hogs, and the expense would be less than twenty-five cents each.

The same kind of care will be necessary in improving our hogs that was used in establishing the valuable breeds we now have. These breeds were made up by selecting the best and breeding with a view to permanently fixing desirable points which were found in these animals, and this careful and intelligent breeding finally resulted in so fixing these points that they would be reproduced with certainty, and then the animal was called a through-bred.

A farmer who is careless and neglectful may start with the best of stock, and in a few generations allow them to deteriorate until they are no better than his neighbor's who has never invested in improved stock. I would not advise the use of a half-blood boar, even though he showed all the good points of his sire, for his progeny will not be likely to give satisfaction. It is certainly penny wise to use an inferior sire for our pigs, and hardly just to the careful breeder to be unwilling to pay him a fair price for his stock. If we will but consider how long and difficult would be the task of building up and establishing the valuable qualities which our best breeds of hogs possess, we shall feel that something is due these men for the service they have rendered the farmer.

Selection of Breeding Stock.—I have already intimated that for the improvement of our hogs the boar is of more importance than the sow. This is true not only because one boar will improve all the pigs of the herd, and so it is much cheaper, but also from the fact, now so well established as to need but the statement, that the male parent determines mostly the outward form and structure, while the female the internal. This is forcibly illustrated by the breeding together of the ass and horse. When the mare is bred to the ass, the offspring is a mule, which is essentially an ass; and a she-ass bred to a stallion produces the hinny, which in outward form resembles the horse. Each animal has the form and voice of the sire. It is also true that with the best bred sows, if scrub boars are used, the stock will rapidly deteriorate; while, on the contrary, one may begin with inferior sows, and by the use of thorough-bred boars constantly improve the stock in form and quality. From these premises it will be seen that upon the selection of the boar will in a great measure depend the success of the breeder. If the farmer expects to sell pigs for breeders, the boar should be of the same breed as the sow; for the offspring of two different breeds will not constitute a thorough-bred, but a cross-bred animal. To produce a thorough-bred both parents must not only be thorough-bred, but also of the same breed. As the male is to give form to the progeny, more attention should be given to form in him than in the sow.

As I can not find a better catalogue of the points desirable in the male than is given by Coburn in his book on "Swine Husbandry," I quote from it the following: "The boar should have a short broad face, with round heavy under-jaw, and thick short neck, indicating strong vitality and assimilating powers, two functions requisite in every first-class meat-producing animal; width between the fore-legs, and large girth immediately behind them, denote room for large and active lungs, the very foundation of any animal. Ribs that are long and well sprung outward from the back show capacity of stomach. The broad loin and well developed ham are signs of active kidneys. A clean, fine, and elastic skin, covered with soft lively hair, and

free from bristles, denotes a healthy liver, and freedom from internal fever. A fine muzzle and limbs, clean small joints, and standing square up on the feet, denotes solidity, strength, and firmness of the animal's frame-work; while the dished or concave face, and slightly drooping ear, are unerring signs of an easy keeper, and a quiet, contented disposition."

Keep in mind in selecting the boar that the hog is a machine for converting raw material into a more condensed and valuable article, and that health, vigor, and well developed digestive organs are the essential qualifications, and the chief value of the points given are that they are indications of these qualities. Whatever the breed, he should be pure, and it is well to inspect the herd from which he is taken to see if the animals show uniformity of excellent points, and if it is found that there is great diversity, I would not advise that a boar be purchased from such a herd, no matter what his individual excellences.

The treatment of the boar is a matter of importance. An animal that has been stuffed and coddled for the show-ring is not likely to give as good satisfaction as one that has had only ordinary care. Many a boar is ruined by being confined in a close pen with no chance for exercise, and fed on rich concentrated food until he has become sluggish and unfit to generate healthy offspring. It is often the case that the boar is allowed to run with the herd to tease and worry until he becomes gaunt and unthrifty, and no management could well be worse, for no record can be kept of coupling, and as a consequence the owner does not know when to expect the pigs, and does not prepare a place for them. Thousands of pigs are lost every year from neglect of this matter. The boar should have a comfortable pen with a lot adjoining, and the fence should be strong, for if he once breaks out and gets a taste for roaming he will be likely to prove troublesome. His food should be varied, and, while nutritious, should not be too concentrated, and he should be kept healthy and vigorous, but not fat. If the boar is properly managed and cared for he may be kept for two or more years, and will be vastly superior to a young pig. With a pen properly arranged and strongly made there is no reason why a boar should

not be kept with little trouble for years. Never allow him to be taken out of the pen, and when turning sows to him have him safely secured in his sleeping apartment, and after the sow is in the lot and shut in, let the boar out. If managed in this way he can usually be kept quiet and gentle. If the first litters show the boar to be one of superior excellence as a pig-getter, it becomes a matter of importance to so manage him that he can be kept for years. One service to a sow is as good as a half-dozen, and I would advise that the sow be removed as soon as served.

In choosing the sow for breeding, we want a roomy, rather than compact animal, as she is to give character to the internal organs rather than the form of her offspring. She should be a good suckler, and if possible selected from a family noted for fertility and motherly qualities. When you find a sow that possesses in a large degree these valuable qualities, it will pay to keep her for years, and no reasonable sum should induce the owner to part with her. I am decidedly in favor of mature sows for breeders. The pigs will be more numerous, larger, and of better constitution, and the mothers will be less likely to overlay or otherwise destroy the pigs. As I look back over an experience of thirty-five years, I find that my losses of young pigs have been three times as great when I have used young sows for breeders as they have been when I have used those which were mature.

When young sows are used for breeding, I would not couple before January, so that the pigs would not come till warm weather and some green food could be had, and I would not breed these sows again for a fall litter. The period of gestation with the hog is one hundred and twelve days, and I think they vary from the regular time less than most domestic animals. I have already spoken of the importance of keeping a record of the time of coupling, and in making the entry it is best to count up the time when the one hundred and twelve days will be out. Your entry for a sow bred December 20th would read as follows:

“Black sow Bess, bred December 20th; pigs due April 11th.”

Two weeks before the pigs are due the sow should be separated from the herd. If it is a season when she can get green food she will do best in a grass lot, and a good shelter should be provided for her to nest in. The more you can handle the sow and accustom her to your presence in the pen the better, as it may be necessary for you to go to her assistance at farrowing time, and if she has never been handled she will be likely to become excited and unmanageable, and destroy her pigs. The less she is disturbed at this time the better, and I would never interfere unless it becomes absolutely necessary.

If the sow must be kept in a pen and no green food can be had, let the food be cooling and loosening rather than heating and constipating. There is no worse food than corn, and none better than bran and roots. It is of still greater moment that strict attention be paid to the diet for the first week after the pigs come. Too heavy feeding, especially of corn, is likely to produce indigestion and induce fever, which dries the milk and leaves the pigs to starve. Whole litters are lost more frequently by over-feeding the sows after pigging than from any, or perhaps even all other causes. I think there are many farmers who lose pigs from over-feeding the sow who do not suspect the cause. They notice that the sow does not eat well, and that the pigs, after perhaps thriving for a few days, begin to dwindle and die off one after another till the entire litter is gone. I make it an invariable rule never to feed more than a single ear of corn at a feed the first week, and regulate carefully the quality and quantity of the slop. It is a time when the owner should attend to the feeding and not entrust it to the boys or hired men. Another cause of loss of young pigs, which is not generally understood, is that they become too fat and die of "thumps" or some kindred ailment, and this is due, I think, to the fact that the sows are fed exclusively on corn, which produces very rich milk, and that the pigs get no exercise.

By the time the pigs are ten days old they should be allowed the run of a lot, and if you have a blue-grass pasture to turn the mother in it is the best place for her. If the sow must be kept shut up, open a crack and let the pigs run out.

You will find that they will soon begin to ramble over the farm, and if it is the planting season they will be likely to do mischief, unless confined to a lot, and there should be, on every farm where hogs are raised, a lot especially for young pigs, with a fence so tight that they can not get through it.

I find the self-supporting fence, which is described in our chapter on "Fencing," the cheapest and best for this purpose. In order that the grass may be saved on this lot, the breeding stock should be rung.

I consider it of great importance that the pigs should be taught to eat as soon as possible, so that their growth will not be checked at weaning time. You will notice by the time they are three weeks old that they will begin to crack corn, and at this time a part of the pen should be partitioned off, or a small pen adjoining provided which the mother can not enter, but so arranged that the pigs can go in and out at will. Here feed a little soaked corn and milk daily, gradually increasing the quantity, but never over-feeding. By the time your pigs are old enough to wean, they will be so accustomed to other food that they will not suffer at all by the change. If there are, as is usually the case, some large and some small pigs in the litter, it is a good plan to leave two or more of the latter to run with the sow a week or two, after the others are taken away, as this will be a benefit both to the pigs and the sow. The best time to castrate pigs is while they are sucking, and if done at this time they will not be damaged or checked in their growth, and there will be little risk attending it.

Whether the pigs are to be fattened at nine or ten months old, kept for breeders, or wintered as stock hogs, the treatment should be the same for the first three months after weaning, for this is the time to develop healthy organs and build up bone and muscle, and to do this we should feed a mixed diet and allow the pigs to run where they will get exercise. They should have some green, bulky food, some slop, and some corn, and be so fed as to keep them thrifty and growing.

The best time for the pigs to come depends somewhat on what disposition we expect to make of them. The farmer who

is raising fancy pigs to sell for breeding stock will want March pigs, and those who keep old sows and raise two litters a year will want the first litter in this month; but I would advise that when young sows are used as breeders coupling be delayed so as to bring the pigs from the middle of May to the middle of June. These pigs, if well fed, will make good pig pork at six months old, or they can be wintered and turned on clover in the spring, and kept for fattening the coming autumn at seventeen or eighteen months old. I think they will make nearly as large and profitable hogs as they would if born in March, when the risk and care would be much greater. With large, well-developed sows, I believe it will pay to raise two litters a year. The cost of keeping a large sow a year is considerable, and a fall litter will usually pay for it. A September pig will require a little better care through the winter than one born in the spring; but I have rarely failed to keep them thrifty, and to make them profitable. When two litters are to be raised it will pay to give extra care to the sow and her pigs, so as to be able to wean the spring litter at six weeks old.

If the second litter comes as early as the first of September it will be all the better. I would not breed a yearling sow for a second litter unless she lost the first one, for to nurse two litters of pigs in a year is too heavy a tax on a growing animal. I have tested this matter fully, and find that the young sow that raises a spring and fall litter never attains the size or perfect development that she is capable of. After a sow is two years old she may, if properly cared for, be bred regularly every six months, and can be made one of the most profitable animals on the farm.

There are several noted sows in my neighborhood that have been bred for some years, and whose pigs can always be sold at high prices.

I addressed letters to the owners of two of them, requesting that they give me the facts for publication.

No. 1, called Bess Stibbins, has raised eight litters of pigs, averaging six to the litter, and forty-five of these have been sold for \$2,350; and three on hand, which are proving as

valuable as the mother, can be sold at one hundred dollars each any time the owner will take it.

No. 2, called the Sholenbarger sow, has farrowed in seven years ten litters of pigs, ninety-four in all. Sixty-two of these have been raised, and sold for \$2,460.

The hog-raiser should watch his breeding stock carefully, and when he finds a combination of valuable qualities in a sow should not part with her as long as she is capable of breeding. I have now in my possession two Poland China sows—sisters—that have each raised two litters of pigs. One of them has proved a kind mother and an excellent suckler, while the other is such a poor milker she can scarcely raise a litter of pigs, and I shall fatten her this fall; yet a stranger would be more likely to select her than the other one, which I know to be worth twenty-five dollars the more. A large, well-developed sow, which has proved herself a prolific and good breeder, a careful mother, and a good suckler, is often a better investment than a hundred dollars in bank.

When the sow is to be bred twice a year she should have the best of care, but should not be fed on corn exclusively, or allowed to become fat, but should run on grass, and have a little corn and good slop.

Diseases of Swine.—I have given much thought and study to this subject, and consulted all the authorities at my command, and the more I have investigated it the stronger the conviction has become that the farmer must avoid loss by preventive and sanitary measures rather than by medication. I would not affirm that he who manages his herd wisely will always escape disease, for in spite of his best efforts he is liable to a visit from an epidemic; but I have never known dosing to be of much benefit in such cases, and I have little faith in any of the so-called specifics offered for these diseases. I have determined, therefore, to speak only of causes and preventives, confident that the enormous losses from diseases of swine, which in a single year have reached fifty millions of dollars, can be greatly reduced if farmers will give more attention to this important subject.

Causes of Disease.—The farmer of a generation ago knew nothing of “hog cholera,” and the reason seems to be that the animal was treated in a natural rather than an artificial way. It was allowed unlimited range, and subsisted largely on bulky food, grasses, roots, and mast, with some animal food in the form of grubs and worms. He was active and muscular, always on the go, and during the greater part of the year thin in flesh, never fat, except late in the fall, after the mast fell, when he fattened up for winter. The modern hog is a dull, sluggish animal, with a ring in his nose to prevent him from rooting; he is confined in a pen or muddy lot for the larger part of the year, and fed on corn exclusively, which is a rich, concentrated, and heating food. In addition to this, the great object of the breeder for many generations has been to develop fat and early maturity, so that it is now easy to attain at ten or twelve months a greater weight than was formerly the result of two years’ feeding.

Another cause of impaired vitality in the hog I believe to be the practice, almost universally followed for many years, of breeding from young sows. Probably nine-tenths of the hogs in the United States for a long series of years were the offspring of parents not over eight months old at the time of coupling, and the mothers nursed their young at a time when all their energies were needed to build up and mature their own bodies.

When we consider these causes, which have so changed the constitution of the hog that from the most hardy of all domestic animals it has become the most subject to disease, our wonder is, not that hogs have become unhealthy, but that the race has not become extinct.

Hog Cholera.—All epidemic diseases of hogs have been given the general name of “cholera,” although there are several forms of disease which are quite dissimilar. There is, perhaps, no better authority on the diseases of swine than Dr. Detmers, who, in addition to large experience in veterinary practice both in Europe and America, has made a special study of this subject. In speaking of the diseases of swine he says:

“I wish to banish the name ‘hog cholera,’ which is ill-chosen, entirely without meaning, and leads to confusion, as it naturally

conveys the impression that the diseases so named are similar to or identical with the Asiatic cholera, or cholera of men, which is not the case. In fact, what our farmers and swine-breeders are used to call cholera is not a single or separate disease, but rather a group of several kindred diseases, similar to each other in regard to causes, morbid process, contagiousness, and final termination, but differing very much as to symptoms, seat of morbid process, course, and duration."

The proper name for all this class of diseases is "Anthrax," which is a Greek word signifying carbuncle or virulent ulcer.

PREVENTIVE MEASURES.—The first thing to be done is to so select and manage the breeding stock as to insure a good constitution and development. Breed only from mature sows, and see to it that your breeding stock comes from a healthy, vigorous herd, and that the food and care are such as to insure a well developed animal. Do not buy show stock at the fairs which has been pampered and overfed, for in a majority of cases it has been injured in this way so as to be unsafe for breeding purposes. The great majority of breeding stock shipped by the men who make a business of furnishing the farmers with pure-bred pigs is made too fat. I do not think the breeders are to blame for this any more than their patrons, for the latter demand that the pigs shall look nice and smooth, and plenty of corn will bring them to this condition.

Pure drinking water should always be provided. I have little doubt that allowing hogs to drink from filthy pools or wallows has been in many cases the cause of the loss of a herd. A few years since the disease broke out with great violence on a farm in my neighborhood, and on visiting the farm to see if any local cause for it could be found, I learned that the supply of water in the well had failed, and the owner had been pumping water from an abandoned cistern located in a barnyard; and on examination it was found that there was two feet of manure settled in the bottom of this cistern. Even where there is pure running water in the pasture it often becomes a means of contamination if the disease prevails on farms above, as the germs of disease will be carried by the water to the pasture below. If

a farmer finds that the hogs of a neighbor are diseased, and the water to which they have access flows through his farm, not a day should be lost in removing his hogs from the fields where they can drink the water. If the owner of a herd notices any signs of disease, or unthriftiness even, he should at once change his treatment of them. Separate the sick from the well, and, if possible, change the herd to a fresh lot or pasture.

I would recommend also a change of food. If the hogs have been on pasture, I would begin moderate feeding with grain and slops. If they have been on heavy corn feed I would give some green food if it could be had, or if not warm slop of bran and oil meal. I have known instances where the disease made its appearance, with every prospect of carrying off an entire herd, when, by an immediate change of diet, its ravages were at once stopped. In one case the disease appeared in November in a herd of sixty spring pigs, and the owner turned them at once on a field of rye and stopped feeding corn. In three weeks all the symptoms of disease had disappeared, and the hogs remained thrifty all Winter.

Another case that came under my notice was a herd of eighty stock hogs that began to show signs of disease about mid-winter. The owner reduced their feed to a single ear of corn each per day, but fed his cattle with which the hogs were running five bushels of corn per day, and allowed the hogs to get most of their living from the droppings of the cattle, and very soon noticed an improvement in the condition of the hogs, and they wintered without further loss.

Another cause of disease I believe to be the practice of feeding in the same lot—and often the same spot in the lot—for years, so that the soil becomes contaminated with the excrement, and in muddy or dusty weather the hogs must take more or less of this with their food. When hogs are confined to a feed lot there should always be a feed floor, and it should be cleaned regularly so as to be free from dung, mud, and dust. Irregular feeding I believe also to be a cause of disease, for any thing that interferes with digestion or lowers the vitality invites disease. It is a common thing to see hogs overfed, so that from

day to day for weeks there is always soiled corn lying by them, and they do not come to their food with a good appetite. I believe such feeding to be not only wasteful, but also to make the hogs more susceptible to disease, and that the farmer who feeds regularly as to time and quantity, and by the use of salt, ashes, and charcoal, maintains a vigorous appetite and good digestion, gets the largest gain from his food and reduces the risk of loss from any and all diseases.

Still another fruitful cause of disease is often found in the arrangements for sleeping. The hogs are not assorted so as to have large and small by themselves, but a large number of all sizes are allowed to pile up together, often in a damp bed, with but little protection from wind or rain. Those in the center of the heap are too hot, and the outer ones too cold. I have often in a cold winter morning seen the hogs come from such a bed steaming as though just out of a hot bath. Even when a dry floor is provided with sufficient protection from cold it is often the case that the bedding is allowed to become foul and dusty, so as to be unfit for use. The beds should be changed before they reach this stage and fresh litter given. I have found corn fodder excellent for this purpose, as the hogs will eat the blades and tear the stalks to shreds, and the bed will remain clean much longer than if made from straw.

I believe that attention to the points which I have named will, in a great majority of cases, prevent disease, and while the selection and application of remedies involves trouble and expense, and is, after all is done, of doubtful utility, these preventive measures are simple, and sure to result in good to the herd and profit to the owner.

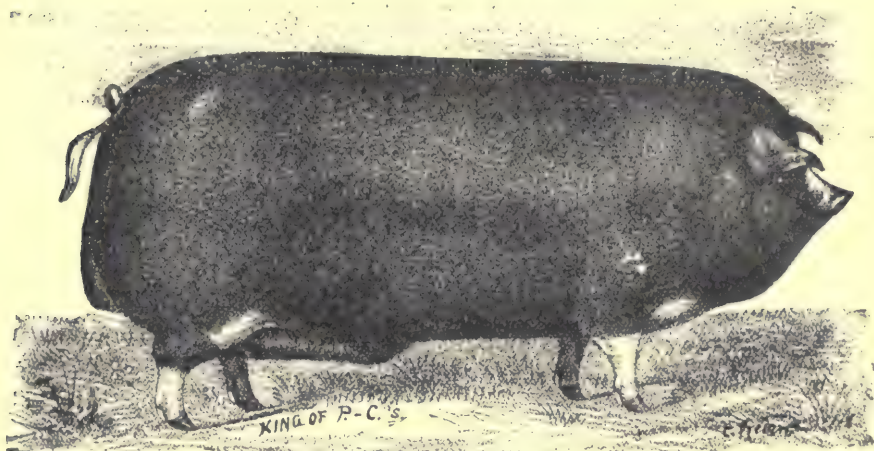
CHAPTER XV.

SWINE—DESCRIPTION OF BREEDS.

THE Poland - Chinas.—There has been interminable wrangling among the breeders of the different strains of these hogs, and enough has been written to fill volumes in trying to prove or disprove the claims of A or B that they were the originators of the breed. It is not my purpose, however, to discuss this question, for it is one in which the general public has no interest, but rather to describe the breed as I have known it from my boyhood. Although breeders differ on many points in the history of these hogs, they all agree that they originated in the Miami Valley, and the farmers on the borders of Warren and Butler counties, Ohio, claim the honor of producing it. Previous to the meeting of the National Convention of Swine Breeders at Indianapolis, in November, 1872, where the name Poland-China was adopted, these hogs were known by a great diversity of names, among which were "Butler County," "Warren County," "Magie," "Miami Valley," "Poland," "Shaker," "Union Village," "Dick's Creek," and many other local names. It would have been wise, I think, if the convention had named them "The Miami Hog," thus perpetuating the locality which originated it, and of which there is no dispute.

The breed was produced by the crossing of the various breeds of improved hogs that had been brought into the Miami Valley at an early day, and among the breeds claimed as having contributed to the formation of the "Poland-Chinas" are the "Byfield," "Russia," "Big China," "Irish Graziers," "Berkshires," and "Poland." On this point there has been much controversy, however, some of the breeders claiming that there was no Berkshire blood used, and others that there was no such

breed of hogs as the Poland, but that the name originated from the fact that one valuable strain of the hogs was produced from a boar owned by an old Polander named Asher Asher. The first importation of hogs of which we have a record which were used in producing this breed was of the Big China, in 1816, while



POLAND-CHINA BOAR, KING OF P.-C.'S, 5,599.

Property of L. N. Bonham and S. E. Shellenberger, Oxford, Butler County, Ohio.

other breeds were brought later, the Irish Graziers not till 1839 or 1840, and it was between 1840 and 1850 that the breed began to attract attention.

During the thirty-five years that I have lived in Butler County, Ohio, I have seen great improvement in these hogs, and I believe the breed now to be as pure and thoroughly established as the Berkshire or any other. Up to twenty years ago I do not think this was true, for there was not at that time uniformity of shape or color such as we now see. It was very common then for sandy pigs, or those with more white than black, to be found in litters bred from parents neither of which showed these colors, and some of the pigs would be coarse and heavy boned, while others were much finer and of more compact build. In the hands of our best breeders they are now found of almost perfect uniformity in color and shape. For ten years or more past the tendency has been to dark colors, and among many of our best breeders the Poland-China can now hardly be called a

spotted hog, as the most carefully bred specimens show but little more white than the Berkshire.

For the great corn-growing regions of the West, there is perhaps, in the estimation of many practical farmers, no other breed that equals this as a pork producer when purely bred, and certainly none that produces a finer and better hog when crossed with the Berkshire. The description of this breed as adopted by the Swine Breeders' Convention that decided on their name is as follows: "They have good length; short legs; broad, straight backs; deep sides, flanking well down on the leg; very broad, full, square hams and shoulders; drooping ears; short heads; wide between the eyes; of spotted or dark color. They are hardy, vigorous, and prolific, and when fat are perfect models, pre-eminently combining the excellences of both large and small breeds." They fatten readily at an early age, and may be profitably fed for pig pork, or if kept till eighteen or twenty months old they make large heavy hogs.



POLAND-CHINA SOW, BLACKFACE MARY, 7,568.

Bred and owned by L. N. Bonham, Oxford, Butler County, Ohio.

The above description, it will be remembered, was adopted in 1872, and during the next ten years the prominent object of breeders was to breed out the coarse heavy bone and ear, and to produce a finer hog. In 1883 a convention of our best breeders adopted the following scale of points:

Head small, broad, dished,	10
Ear thin, fine, drooping,	3
Neck short, full, well arched,	4
Jowl neat and full,	2
Brisket full and deep,	3
Shoulder broad and deep,	7
Girth about heart,	9
Back straight and broad,	5
Sides deep and full,	9
Ribs well sprung,	9
Loin broad and strong,	7
Belly wide and straight,	5
Flank well let down,	3
Ham broad, full, and deep,	10
Coat fine and thick,	4
Limbs strong, straight, and neat,	5
Tail tapering, and not coarse,	2
Color dark spotted,	3
Total,	100

As a specimen of the weight which can be made with these hogs I give the following, which has been vouched for by the owner of the hogs:

In 1867 a sow belonging to Mr. Thomas J. Conover, of Butler County, Ohio, produced eleven pigs on the 18th day of April. In October following she and her pigs weighed 2,735 pounds. The sow pigs were kept for breeders, but five barrows of the litter at eight months and twenty days old averaged 282 pounds, and the sow fattened the same fall weighed net 535 pounds. In 1869 the same gentleman exhibited a sow and six pigs that weighed 2,000 pounds, the pigs being but five months old.

The Berkshires.—In numbers and importance the Berkshire hog stands next to the Poland-China, while by many farmers they are preferred to any or all other breeds. They were introduced generally into the United States about the year 1832, although one or two importations had been made previously, one as early as 1823, and for ten years there raged what might be called a Berkshire fever. They sold at fancy prices, often bringing from \$50 to \$100 per pair, and that at a time when hogs and the hog products were uniformly low priced, ordinary hogs selling at from one to three dollars per hundred pounds. Doubtless stimulated by these high prices dishonest dealers sold grades as pure bred, and farmers at that early day were not prepared to

give the care to these hogs that they required, and the consequence was that a reaction set in, and farmers became disgusted with them so that the very name of Berkshire was an offense.

It was not until new importations of the finest specimens of the improved Berkshires that could be found in England were brought to this country, about 1865, that the real merits of the breed became known, and the prejudice against them began to abate. They have generally been called a small breed, but the improved Berkshire now is but little inferior in size to the Poland-China. J. A. Brown, of Milton, Illinois, sold a lot of Berkshire pigs, nine months old, that averaged three hundred and five pounds, and they are often found at eighteen and twenty months old that will weigh five hundred pounds, or more.

The points of excellency claimed for them are: 1st. Great muscular power and vitality, which renders them less liable to disease than many other breeds. 2d. Activity combined with strong digestive and assimilative powers, which enables them to give good returns in flesh and fat for the food consumed. They are excellent grazers, and their meat is marbled or streaked with lean, making the hams more desirable than those of other breeds that are more inclined to fat. 3d. The sows are unequaled as mothers, being prolific, good sucklers and very careful nurses. 4th. The pigs are strong and active at birth, and not so liable to mishaps as those of many other breeds. 5th. They may be fattened young, making the finest quality of pig pork, or if kept till maturity they can be fed to any reasonable weight. 6th. They are unsurpassed by any breed for uniformity of color, marking and quality, and in the power of the boar to transmit the valuable qualities of the breed to its progeny when used as a cross. When crossed with the Poland-China they make the best feeding hog in existence, whether they are to be fed at eight to ten months old, or kept over to be fattened at maturity. The breed is so prominent, and its merits so well understood that an "American Berkshire Association" has been formed and a herd book published.

This convention agreed upon the following as the characteristics and markings of the Berkshire hog: "Color black, with



QUEEN MAB 10184

ROYAL GLOSTER 10195

JULIETTE 10193

BERKSHIRE SWINE.

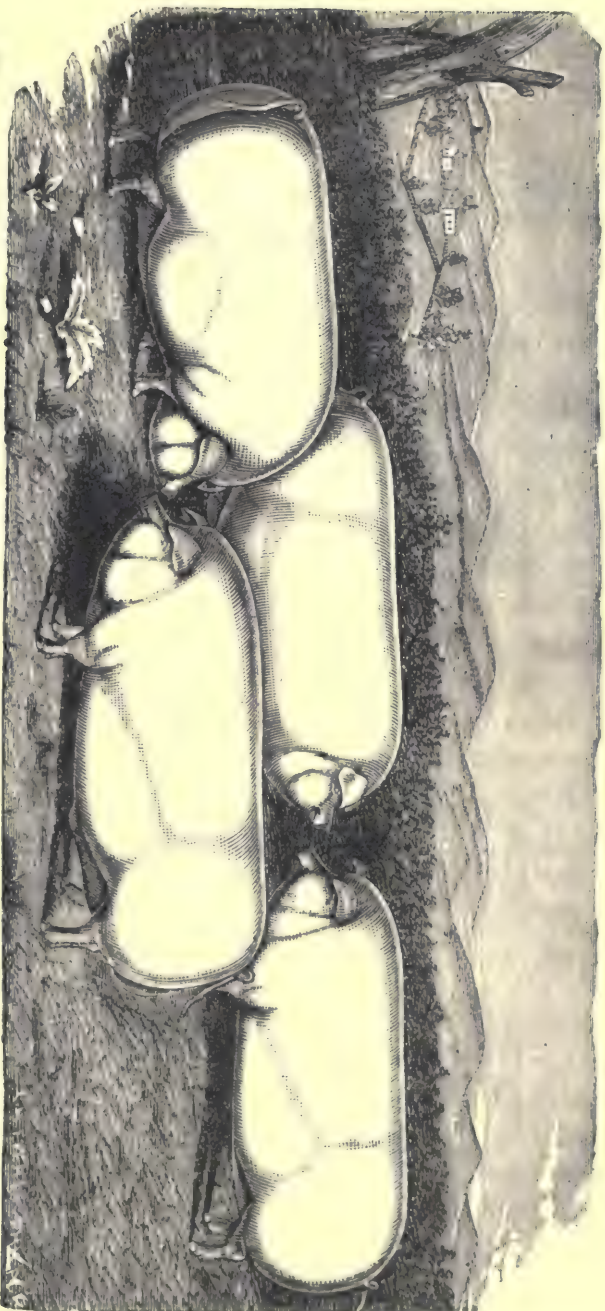
Property of George W. Penney, Newark, Ohio.

white on feet, face, tip of tail, and an occasional splash of white on the arm, and a small spot of white on some other part of the body does not argue an impurity of blood, yet it is to be discouraged to the end that uniformity of color may be attained by breeders. White upon one ear, or a bronze or copper colored spot on some part of the body argues no impurity, but rather a reappearance of original colors. Markings of white other than those named above are suspicious, and a pig so marked should be rejected.

“Face short, fine, and well dished, broad between the eyes; ears generally almost erect, but sometimes inclining forward with advancing age; small, thin, soft, and showing veins, jowl full, neck short and thick; shoulders short from neck to middling, deep from back down; back broad and straight, or a very little arched; ribs—long ribs well sprung, giving rotundity of body, short ribs of good length, giving breadth and levelness of loins; hips good length from point of hip to rump; hams thick, round, and deep, holding their thickness well back and down to the hocks; tail fine and small, set on high up; legs short and fine but straight and very strong, with hoofs erect, legs set wide apart, size medium, length medium (extremes are to be avoided); bone fine and compact, offal very light, hair fine and compact, skin pliable.”

With the points of excellence combined in the pure bred Berkshires the farmer who breeds them is not likely to be disappointed.

The Chester Whites.—The Chester White hog belongs to what are designated as the large breeds, and have been described as a coarse, hardy breed, of good constitution. Under the hands of our best breeders they have been improved and refined until they are of as good form and quality as the Poland-China, and if of the same color might easily be mistaken for them. One thing has tended to bring them into disrepute, and that is that many mongrel white hogs were sold as “Chester White” that were as ill-bred and devoid of valuable qualities as it is easy to conceive of a hog being, and wherever these were sold the entire neighborhood became disgusted with the name.



855

OLD QUEEN.

LADY LAFORTE.

PERFECTION.

BEAUTY.

SWEETSTAKES HERD OF IMPROVED CHESTER WHITE HOGS,

Owned and bred by S. H. Todd, Wakeman, O.

The breed originated in Chester County, Pennsylvania, from which it takes its name, and probably dates back to an importation made from England in 1818, thus outranking the Berkshire in the length of time they have been bred in this country. Some have objected to them because they are too large, but as they will fatten readily at any age this does not seem a valid objection. There has been a marked improvement in the breed during the past few years, and the coarseness of bone, head, ears, and hair has been greatly reduced. Among the farmers at the West they have never become popular, as they are thought in this climate and under the Western system of treatment to be subject to skin disease, especially mange.

The points adopted by the National Convention for this breed are as follows: Head short, broad between the eyes; ears thin, projecting forward and lap at the point; neck short and thick, body lengthy and deep, broad on back; hams full and deep; legs short and well set under for bearing the weight; coat thinish white, straight, and if a little wavy not objectionable; small tail, and no bristles.

The Essex.—The Essex hog is rarely found in the West, and has never been bred to any great extent for pork. It belongs to the small breeds, weighing when mature from two hundred and fifty to two hundred and seventy-five pounds. No hog ever bred in this country can claim greater purity of blood, and perhaps none is more valuable to use for crossing on the larger breeds.

The merits specially claimed for them are early maturity and excellent quality of flesh. As graziers they are unexcelled by any other breed, and will keep in good breeding condition on grass alone, and will often come from the pastures fat enough for the butcher. They are never affected with mange or any of the skin diseases to which white hogs are subject. Their greatest defect is a delicacy of constitution, causing them to require much care when young, and an excessive aptitude to fatten, which often diminishes the fertility of the sows.

They are described as follows: "Color, black; face, short and dishing; ears small, soft, and stand erect when young, but

droop somewhat with age; carcass long, broad, straight and deep; ham heavy and well let down; bone fine; carcass, when fat, composed mostly of lard; hair ordinarily rather thin. The



ESSEX BOAR.

fattening qualities are very superior. They are prolific breeders and fair nurses.

There is a larger strain of this breed called the Improved Essex. This improvement was made by an English breeder who crossed with the Neapolitan pig. They have also been introduced into this country. These improved Essex, while they mature early and make the best of pig pork at from five to eight months old, will, if kept to maturity, attain a weight of four to five hundred pounds.

Jersey Reds.—This breed seems to be gaining some prominence, and undoubtedly possesses qualities capable of making it valuable. A convention of the Western breeders of these hogs was held in June, 1883, at which the name of Duroc or Jersey Red was adopted.

The name Duroc, it appears, had been used for these hogs for many years before the name Jersey Red was applied to them. The Duroc hog of Saratoga County, New York, has an authenticated history dating back as far as 1824, while it was not till many years later that they were called Jersey Red. The above state-

ment is on the authority of Colonel F. D. Curtis, who gives it as his belief that all the red hogs in America are descended from the original Berkshires. The same hog undoubtedly is bred in many parts of the country under the name of Red Berkshire. There is at present quite a diversity in the appearance of different families of these hogs, some of them being very large and coarse, while others have been bred to a medium size and finer form.

The standard of characteristics adopted by the convention of breeders of these hogs is as follows: "The true Duroc or Jersey Red should be long, quite deep bodied, not round but broad on the back, and holding the width well out to the hips and hams. The head should be small compared with the body, with the cheek broad and full, with considerable breadth between the eyes. The neck should be short and thick, and the face slightly curved, with the nose rather longer than in the English breeds; the ear rather large and lopped over the eyes and not erect; bone not fine nor yet coarse, but medium; the legs medium in



JERSEY RED HOG.

From William Henry Maule, Philadelphia, Penn.

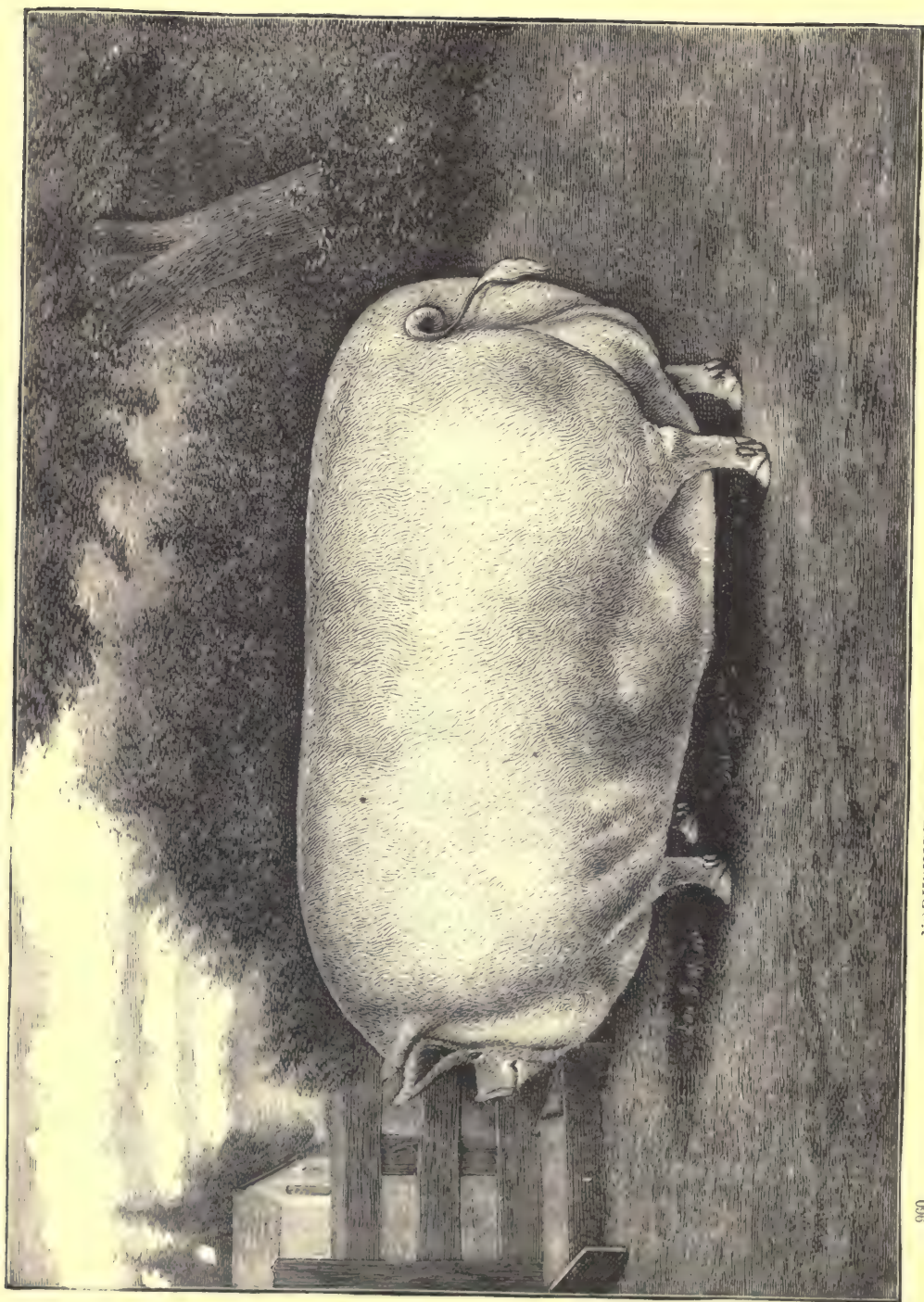
size and length, but set well under the body and well apart, and not cut up high in the flank or above the knee; the hams broad and full, well down to the hock. There should be a good coat of hair of medium fineness, inclining to bristles at the top of the shoulders, the tail being hairy and not small. The hair usually straight, but in some cases a little wavy. The color

should be red, varying from dark glossy cherry red, and even brownish hair to light, yellowish red, with occasionally a small fleck of black on the belly and legs. The darker shades of red are preferred by most breeders, and this type of color is most desirable. In disposition they are remarkably mild and gentle. When full grown they should dress from four hundred to five hundred pounds, and pigs at nine months old should dress from two hundred and fifty to three hundred pounds."

The points of value claimed for these hogs are, their large size, strong constitution, and capacity for growth. They are not subject to mange.

The Suffolks.—The Suffolks are not raised to any great extent in the pork-producing States, as they are somewhat delicate, and difficult to raise. The objections to them are their small size, that they are poor nurses, and that they have a tender skin and thin hair, and can not endure the exposure to which the hog in the pork-producing region is subjected. In short, they are a fancy pig for the amateur, rather than a profitable one for the farmer. Probably the finest herds of Suffolks in this country have been bred by Hon. John Wentworth, of Cook County, Ill., and Mr. William Smith, of Detroit, Mich., both of whom have bred them for many years, and have long been enthusiastic admirers of the breed. *

The characteristics and markings of the breed are given as follows: "Head small, very short; cheeks prominent and full; face dished; snout small and very short; jowl fine; ears short, small, thin, upright, soft, and silky; neck very short and thick, the head appearing almost as if set on front of the shoulders; no arching of crest; chest wide and deep; elbows standing out; brisket wide, but not deep; shoulders thick, rather upright, rounding outwards from top to elbow; wide and full sides and flanks; long ribs, well arched out from back; good length between shoulders and hams; flank well filled out, and coming well down to ham; back broad, level, and straight from crest to tail, no falling off or down at tail; hams wide and full, well rounded out; twist very wide and full all the way down; legs small and very short, standing wide apart, in sows just keeping



YORKSHIRE BOAR—Property of W. C. Norton, Aldenville, Pa.

the belly from the ground; bone fine; feet small, hoofs rather spreading; tail small, long, and tapering; skin thin, of a pinkish shade, free from color; hair fine and silky, not too thick.—color of hair pale yellowish white, perfectly free from any spots or other color; size small to medium.

The Yorkshire.—The Yorkshire hog is rarely to be found in the United States, and for what knowledge I have of them I am indebted to the report submitted to the National Swine Breeders' Convention. The committee claim "that the white Yorkshire, as now established in this country and England, is the most thorough-bred hog known." They recommend them as valuable to breed from or to cross on other breeds, and give the following reasons for this recommendation:

"1st. They are of a size, shape, and flesh that are desirable for the family or the packers' use.

"2d. They have a hardy, vigorous constitution, and a good coat of hair protecting the skin so well, either in extreme cold or hot weather, that it rarely freezes or blisters.

"3d. They are very quiet and good graziers; they feed well, and fatten quickly at any age.

"4th. They are very prolific and good mothers; and the young never vary in color, and so little in shape that their form when matured may be determined in advance by an inspection of the sire and dam."

There is a strain of these hogs called the "Yorkshire Medium or Middle-breed," which has been produced by a cross of the large and the small York and the Cumberland. These are about the same size as the Berkshire, but have smaller heads, and are lighter in the bone.

The Cheshire.—These hogs are also called the Jefferson County Swine of New York. Probably there is no better authority on these hogs than Mr. J. H. Sanders, editor of *National Live Stock Journal*. He says of them, in "Coburn's Swine Husbandry:"

"In my opinion, the Cheshire is simply a derivative of the Yorkshire. I bred the so-called Cheshire for six or seven years, and took a deep interest in noticing the variations and changes

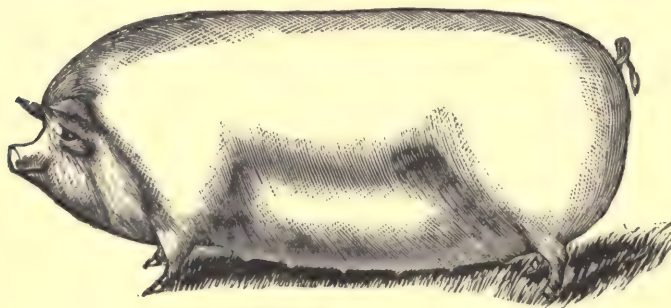
that were produced in that time by selection, in-breeding, and crossing. Within the space of seven years, without introducing any blood but what was supposed to be pure, I produced all the different types of the Yorkshire, from the large York down to



CHESHIRE BOAR—PRINCE ALBERT.
Property of W. G. Smith & Co., Mansfield, O.

the Lancashire Short-face. The white color was firmly fixed; and I never knew one of my Cheshire boars to get a pig that had a black hair on it, although they were bred to sows of all breeds, including the purest Essex.

“The type which I finally succeeded in fixing upon the Cheshires was almost identical, in size, form, and quality, with the most approved medium Berkshire. Indeed, so marked was this resemblance in every thing but color that they were often



CHESHIRE SOW—ALICE I.
Property of W. G. Smith & Co., Mansfield, O.

facetiously called white Berkshires. As bred by me, I regarded them as among the very best of white hogs. They were well haired, had a very delicate, pink skin, and their meat was most excellent, tender, and juicy.”

Mr. Smith, who furnishes us the cuts of this breed, says of them: "From the most reliable information, this most valuable breed of swine were originated by crossing the very large Cheshire with the pure bred Yorkshire and Lancashire, and were exhibited with very great success at all the leading fairs in the State of New York from twenty-five to thirty years since, carrying off nearly all the premiums wherever exhibited. They were sometimes exhibited as Cheshire and Yorkshire, or improved Cheshire in many instances; but having been bred pure for many years in a direct line, without a particle of blood of any of the dark breeds, they are now, and have been during many years past, regarded as a distinct breed, and the males, therefore, possess to a most wonderful degree the power of impressing their own form, characteristics, and pure white color when crossed upon other breeds. They are larger than the Suffolks, with a much finer bone and coat than the Chester Whites, and grow equally as large, with a much greater aptitude to fatten at an early age. Their great value over other breeds consists in their quiet, gentle disposition; their ability to produce and care for large litters; their lean, juicy hams and shoulders; their choice breakfast slices, and fine grazing qualities. All admirers of high bred, pure and white swine will be very greatly interested in the rearing of this important breed."

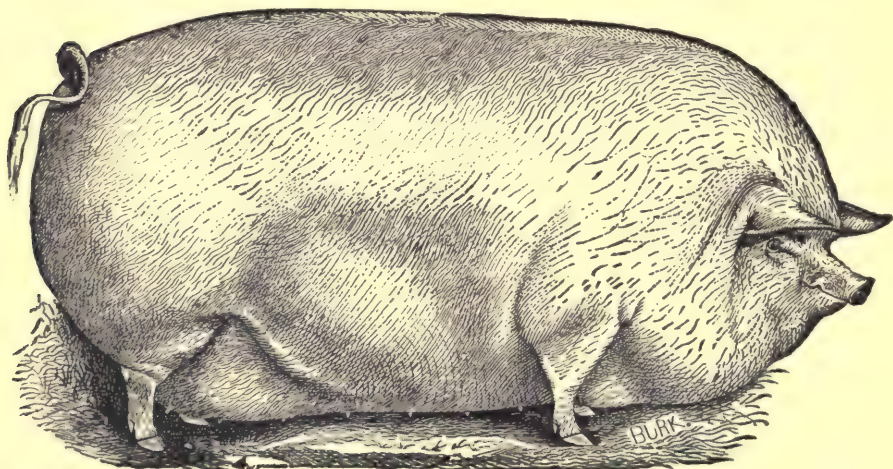
Lancashires.—There are three families of this breed of hogs. 1st. "The Short-faced Lancashire;" 2d. "Large Lancashire," and 3d. "Lancashire Middle Breed."

The first is described as follows: Face short from the eyes to the end of the snout; prick ears, small bones, a good coat of white hair, cubic in form, with broad back and broad hams well set down. The skin as well as the hair is white, although an occasional one may be found having a few dark blue spots in the skin, but never dark or black hairs. These hogs were first imported to the United States in 1870. Several subsequent importations have been made.

"The Large Lancashires" have large bone, are of great height and length, and are claimed to be the largest breed of hogs known. They were first imported in 1870.

"The Lancashire Middle Breed" has been obtained by crossing the large sows with the small boars, and it partakes of the small breed, while it gets its size from the large.

Victorias.—Colonel F. D. Curtis, of New York, has produced several crosses of a pure white hog, to which the name "Victorias" has been given. At the National Swine Breeder's Convention a special committee was appointed to prepare a report upon this breed, who offered the following, which was adopted: "The special committee to whom was referred the report of the committee on Victorias, would respectfully report that having considered the same, we can only add that the efforts of Colonel Curtis are to be commended, and that his success, so



VICTORIA SOW—QUEEN VICTORIA.

Property of G. M. Emerick, Chicago, Illinois.

well indorsed, is another evidence of the ability of the swine breeders of America to create, by judicious crossing of the pure breeds upon the swine of their respective localities, just such a hog as their climate and commercial interests demand. We would bespeak for the Victorias a hearty welcome and a fair trial by intelligent breeders in the various States."

CHARACTERISTICS AND MARKINGS OF THE VICTORIAS.—The color is white, with a good coat of fine, soft hair; the head thin, fine, and closely set on the shoulders; the face slightly dishing; the snout short; the ears erect, small, and very light or thin; the

shoulders bulging and deep; legs short and fine; the back broad, straight, and level, and the body long; the hams round and swelling, and high at the base of the tail, with plaits or folds between the thighs; the tail fine and free from wrinkles or rolls; feathers or rosettes on the back are common; the skin is thin, soft, and elastic; the flesh fine grained and firm, with small bone and thick side pork. The pigs easily keep in condition, and can be made ready for slaughter at any age." They can easily be made to weigh from three hundred to four hundred pounds at twelve months old, and even these weights have been exceeded. They possess great prepotency, transmitting with uniformity their color and good qualities to their offspring. They are excellent breeders, and the pigs are hardy.

CHAPTER XVI.

SWINE—HOUSING AND FATTENING.

HOG-HOUSES and Pens.—To insure success with young pigs, good shelter must be provided. An incalculable number of pigs are lost every year for the want of this. A good hog-house can be made so cheaply that no farm should be without one or more. I have experimented considerably to ascertain the best and cheapest way to build a piggery, and have finally settled on a plan that combines economy and convenience, and possesses, in my judgment, more good points than any I have ever seen. In visiting and inspecting hog-houses before I had put up any, I found in nearly every instance that they were too expensive, and often that they were badly located or defective in some way, that they were not arranged so as to economize space, or to be convenient to clean; or that they were so situated as to allow the manure to waste, or so managed as to be an offense to the nostrils. I have visited farms where the hog-house was as strongly framed as the barn, with sills a foot square, and eight-inch posts, and the frame alone, without a board or shingle on it, cost as much as the completed building should.

I have built during the last twenty-five years six hog-houses on my own farms, and in the later built ones I have secured better accommodations than in those I built first, and at half the cost. Instead of building one large, elaborate building, I prefer two or more smaller ones, as may be necessary. One reason for this is that I think it an advantage to be able to move the hog-house occasionally, as the ground is likely, in the course of years to become contaminated, and such a house as I build can be moved two or three times its length at an expense of two or

three dollars. I build with light material and what is called a balloon frame, by which I mean that there is no mortising or tenons, but that it is put together with spikes. This in a small building I consider as good as a heavy frame, for every board in such a building is a brace, and when complete it is as firm as if built of the heaviest timber. After trying different widths, I have adopted eight feet, as I find this gives ample room for all the hogs that can be accommodated at the trough.

The pens can be made any length to suit. I have now on my farm four, one 12, two 14, and one 16 feet long. Two or more of these pens can be built independent of each other, but, if desirable, they can be set end to end so closely that but one of the ends that come together will need to be weather-boarded. I find a house eight by fourteen feet will accommodate comfortably twelve stock hogs of from eighty to one hundred and twenty-five pounds each, and I have fattened in one of this size ten weighing three hundred pounds each, but they were a little crowded at the last, and I would not recommend more than eight large hogs for a pen of this size. When we use these pens for brood sows we have movable partitions to divide them into two equal parts, and that these partitions may be always on hand, when not in use, we keep them on a rack made for the purpose under the highest part of the roof. As there should be no cracks in the partitions where there are young pigs, we arrange to drop the boards in singly, on top of each other, till the partition is high enough, and then, to prevent the sows from raising them we put a strong pin above the top board. These hog-houses may be made quite tasty by giving a little extra pitch to the roof and allowing it to project so as to finish up with a cornice.

If crib or storage-room is wanted, the posts can be made high enough to give a loft above. One of mine, eight by twelve feet, is made in this way, and we can store seventy-five bushels or more of corn above it, and find it a very convenient place for drying seeds.

In connection with each of these hog-houses we have an outside pen of equal size, always floored so as to keep the hogs

from the ground, and the floor from a foot to eighteen inches lower than that of the house. It will be necessary to make a bridge furnished with cleats to prevent the hogs from slipping as they pass from the lower floor to that of the house. In this outside pen we keep a supply of straw, cornstalks, or some other good absorbent, and find that the hogs make a large amount of valuable manure here.

It is impossible to keep a hog-house clean if the hogs are confined to a single room with the floor on one level; and if an outside pen, without a floor, is allowed, the result will be a filthy wallow, reeking with foul odors. With the outside pen floored and supplied with absorbents a hog-house will never become offensive, and it will be an easy matter to keep the house clean. I make the floor to the outside pen of cheap lumber, using inch boards laid on old pieces of scantling, laid flat on the ground. I can get good beech boards at one dollar and a quarter per hundred, and at this rate all the material for the floor costs but

about two dollars, and it will last five or six years, when it will need to be renewed.



HOG-HOUSE.

The engraving shows a cut of one of my hog-houses, eight feet wide and fourteen long, without loft. I would advise that the roof

be made steeper than shown in cut. For a foundation to a house of this size you can use locust or other good posts, large boulders, or brick or stone pillars. The bill of lumber is as follows :

2 sills 6 inches square and 8 feet long,	. . . . .	48
5 joists 2x10 and 14 feet long,	. . . . .	117
Flooring common inch, laid double,	. . . . .	200
4 posts 4x4, for the corners,	. . . . .	32
2x4 studding for plates, nail ties, etc.,	. . . . .	48
8 rafters 2x4 and 10 feet long,	. . . . .	52
Inch siding,	. . . . .	280
Sheathing,	. . . . .	100

Total feet of lumber, 877

This 877 feet of lumber, at \$1.75 per 100, would cost	\$15 34
To which add 1,000 shingles,	4 25
Nails,	1 50
Making a total of	<hr/> \$21 09

as the cost of materials for this hog-house.

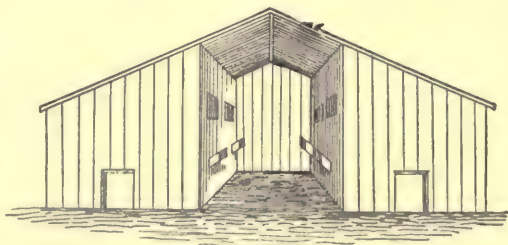
Any one who can use a level, saw, and hatchet can build it, and two men will complete one of them in two days, which would bring the cost to about twenty-five dollars, and five dollars more will make the outside pen. In many localities where lumber is cheap this cost could be considerably reduced, and where the farmer could furnish logs for the lumber and with his farm-help do the work the cash outlay would be very small.

Lest our readers who have been accustomed to heavy frames should think that such a house as I have described would not be strong and durable, I will state that I have one now doing duty that has been built eighteen years, and is good for some years' service yet.

To build a house of this kind first prepare the foundation, and see that it is square. Then place the short sills just fourteen feet apart from out to out, and level them. Now set the joists on them, and bridge them in the center, so that the weight will come on all alike. Next lay the floor, and although I recommend that it be double, it is better that there be wide cracks (two inches or more) in the lining, as it will dry out better than if laid close. I have tried two-inch lumber for floors, and I very much prefer the double inch; it is easier laid and makes a tighter floor and is much cheaper, as the lining may be of cheap lumber and need not cover entirely. Where no loft is wanted (and the above estimate is for a house without a loft) I make the rear posts four and a half, and the front ones seven and a half, feet long. This will give sufficient pitch to the roof, and a fourteen foot board will cut one length for the front and one for the rear. Saw the posts square, and set them on top of the floor, toe-nailing them down, and spike a two by four studding on to the top, front and rear, for a plate. See that they are plumb, that the corners are square, and that the posts, plates, nail-ties, and end rafters all stand flush with the sills and floor joist, for

in boarding it the boards should extend a little below the sill and joists, and be nailed to them, both for protection and to give strength to the building. The tops of the end boards should also be nailed to the end rafters. An extra nail-tie will be needed at each end and one in front at the bottom of the windows, but the plate will be so low in the rear that an extra nail-tie can be dispensed with. I find four and a half feet high enough for the roof at the rear, as it rises so that one can stand straight in the middle of the pen. No braces are needed in a low building of this kind, for the boards being nailed to plates, sills, joists, and rafters brace it perfectly. If, however, tall posts are used so as to have a loft of considerable size, and a heavy weight of corn is to be stored in it, I would brace it and use heavier posts and ties, but this would add but little to its cost. I prefer to have the building extend east and west, and face the south, so as to admit the sun, for we use the hog-house more in winter than in summer, and if used in hot weather the hogs can find shade at the north side of the house in the outside pen. When used for early pigs it is advisable to have glass windows which can be opened or closed at pleasure.

I do not think best to give descriptions of any of the elaborate and expensive piggeries, such as are illustrated in most of our books on hogs, for I feel satisfied that this plan or some modification of it will suit the practical man who wants an economical and convenient building for this purpose. The builder can consult his taste and means in the material used, the size, height of story, amount of ornamental finish, etc.; but by adhering to the general plan I give, I believe he can get the most room for the least money. If a large hog-house is wanted, and a



DOUBLE HOG-HOUSE AND FEED-ROOM.

feed and store room attached, I would recommend that two such buildings be put up facing each other, and eight or ten feet apart, and the rafters allowed to project until they meet. This

would give a feed-room between the houses at no expense except a little for roofing, and even without increasing the length of the posts would give a large amount of room for storage overhead. I estimate that a building twenty-six by twenty-eight feet, with the outer posts ten feet long and the inner thirteen, which would give room for thirty-two large or fifty small hogs and a commodious loft, could be built for one hundred and fifty dollars if all the material was bought, and where a good part of this could be furnished from the farm this sum could be materially reduced.

Portable Pig-pens.—Among our breeders of fine pigs, for shipping, portable pig-pens have become quite common. The portable hog-house is the invention of L. N. Bonham, and is built in sections and fastened together with keys. The object of this is to enable them to be taken apart and stored under cover when not in use. For practical use, however, this is not necessary, and as it is less labor to make them permanent, I recommend that they be made so. When these portable pens are used for March pigs, it is a great advantage to have the short slope of roof, with a row of glass, so that the sun will warm up the pen; but usually this is omitted, and the roof allowed to run up with a single slope. It will pay to make the roof of matched boards and paint it well, as this will be lighter to handle than shingles. For the sides I use dressed stock boards one foot wide. The best way to move these pens is to load them on a low sled, or if they are to be moved but a short distance, four men can easily carry one.



PORTABLE PIG-PEN.

In these and other breeding-pens there should be a guard to prevent the mother overlaying her pigs. All that is necessary is a two by four scantling, six inches above the floor, placed flat, so that the width will project into the pen. If the sow lies down against the wall this gives room for the pigs to pass round under this scantling, and prevents her from crushing them.

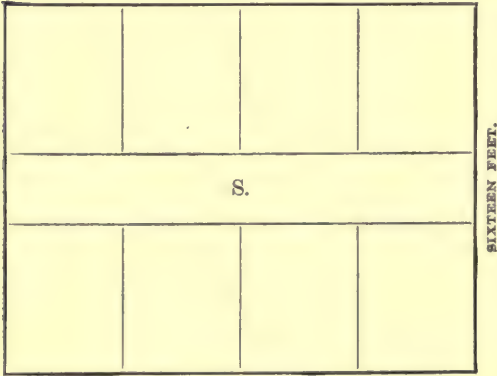
In the portable pen the lower piece to which the boards are nailed can be placed in the right position to act as a guard. The door is hung with a pivot hinge, so as to remain always closed. I would recommend, where this is used, that a small aperture be made for the pigs, as they will not be able to manage the door till some weeks old.

These pens are not expensive, as about one hundred and twenty-five feet of lumber will be sufficient for one of them. Care should be taken to place them where there is no danger of their being flooded, and when used for early spring pigs it is prudent to bank up a little around them so no cold can enter.

As March pigs are a necessity to the breeder of fine stock, and also to the farmer who wishes to fatten his pigs without wintering them, and the weather is so uncertain at this season, the cold winds and driving storms causing enormous losses of pigs, I am convinced that on farms where hogs are a staple product it would pay the farmer to arrange for warming the breeding-pens by fire. Some years since I called on Mr. Wm. Greer, on a blustery March day, and found him in an old ten-

ant house which he had partitioned off into eight pens, five by six feet each, with a hall four feet wide through the center, in which stood a stove (S), a swill-barrel, and a few sacks of ground feed.

The diagram shows how the pens were arranged. Each compartment had a small door



HOUSE FOR BROOD SOWS ARRANGED FOR FIRE.

communicating with the lot in which the building stood. It will be seen that a building sixteen by twenty feet would accommodate eight sows; and a building of this size would not be costly, and all the partitions could be made movable, so they could be taken out, and the room used for other purposes during the larger part of the year. If the double hog-house which I

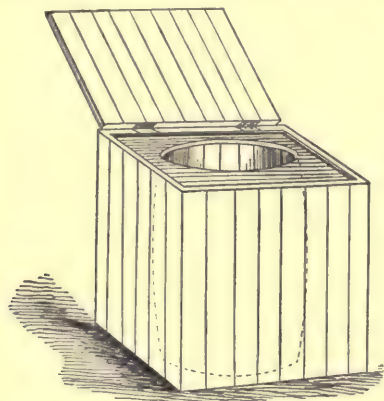
describe and illustrate was made warm, with the cracks battened and a tight floor overhead not more than seven feet from the feeding-floor, I think a large stove would soon raise the temperature so that there would be no danger of pigs chilling in the worst weather. I do not recommend hot-house treatment for pigs, and probably no fire would be needed after they were a week old, and in favorable springs it might not be necessary to fire up at all; but it would certainly pay in bad seasons, and the expense would be so small that the saving of a single litter of good pigs would pay for putting up the stove.

Swill-barrels and Troughs.—An inspection of the swill-barrel on many farms would reveal one cause of unthrifty pigs. In summer it would often be found sour as vinegar and in winter frozen. Hogs will eat and thrive on fermented food, and I think fermentation, when properly regulated, of great value to them; but as a loaf of bread burned to a cinder is ruined by the process of baking, which is necessary to prepare it for food, so a barrel of swill can be rendered unfit even for the stomach of a hog by excessive fermentation. In hot weather fermentation is so rapid that it is necessary to give attention to the swill-barrel every day. The better way is to have two barrels, and empty one each day, and in this way the swill will not become too sour. When I use but one barrel I stir once a day enough meal to last twenty-four hours. The best time to do this is after feeding in the evening, so there will be time for it to be well soaked and fermentation to begin before the next feed. I leave a little of the old swill in the barrel to act as leaven to start it, and adjust the amount to the weather. If quite warm less will be required, and if cool more.

In cold weather I raise the temperature by the addition of boiling water, and either use two barrels or add a little bran and meal each time I feed, for I wish to have the food slightly fermented the year round, and with proper management I find this as easy in winter as in summer.

For winter I pack the swill-barrel in sawdust. I set it in a box of such size that there shall be a space of at least eight inches around it, which I fill with dry sawdust. The box

should be a few inches deeper than the barrel, so that there will be room to cover the latter with two or three thicknesses of old



PROTECTED SWILL-BARREL.

carpet, and shut the lid to the box. A barrel arranged in this way will not freeze unless the temperature is very low, and then a gallon or so of boiling water poured in, night and morning, will prevent it. It will be but little trouble or expense to arrange a box of this kind, and if it is emptied in the spring and stored in a dry place it will last for years.

I would recommend that it be always emptied in the spring, as the sawdust will get wet and rot the box, and is likely to become contaminated and unwholesome.

I have found no trough so cheap and satisfactory as the V trough. Where the hogs have access to both sides of it it should be made of two-inch lumber, but when placed against a wall an inch board will answer for the back side. It should be strongly nailed together, the ends well fitted, and be securely fastened to its place. A good spout or conductor should lead to it, or if more than eight feet long there should be two of them, as if the trough is long the hogs will huddle around the spout so as to keep the swill from flowing readily. Strips nailed across the top and notched into the sides, so as to be level, will prevent the hogs from lying down in the trough and straining and spreading it so as to cause it to leak. Unless there is water in the lot a separate trough should be provided, and a supply of pure water given them in it, for slop will not take the place of water.

Shall We Cook Food for Hogs?—Twenty-five years ago I should have answered this question in the affirmative with not a doubt in my mind that I was right, and that no good argument could be given against it. At different times I invested in steamers, boilers, furnaces, and other apparatus for cooking

food, but in every case the labor and expense seemed to me to outweigh any gain received from it. I still, however, accepted as true the statement that one-third of the food could be saved by cooking, and attributed my want of success to the fact that I did not keep hogs enough to make it an object, and that fuel was expensive, as my farm is without timber. Finally, I determined to investigate the matter more fully. On looking around among my neighbors I could not find a single one who had begun the practice of cooking food some years before but had abandoned it. When asked why they were not cooking food for their hogs the general reply was, "too much trouble."

In 1877 Mr. Simon Emerick, an enterprising farmer of Montgomery County, Ohio, determined to investigate the matter, and entered into correspondence with a large number of farmers living in ten different States, with a view to getting at the truth of the matter. He found wonderful claims for the superiority of cooked food from those who were new in the business or who were interested in the sale of apparatus for cooking, some claiming that a given amount of corn fed raw gave but five pounds of pork, while the same amount cooked gave over fourteen pounds, and when ground and cooked gave from sixteen to eighteen pounds. Others stated that half the corn was saved, and still others, one-third.

Mr. Emerick kept up his investigation for several years, and found that some of the most ardent advocates of cooking food changed their minds. For example, a gentleman in Wisconsin wrote in 1872 as follows: "I find by a test with the scales that seventy-two pounds of ear corn steamed made twenty pounds of pork; the same amount fed raw made ten and a half pounds. I sold at eight cents a pound, and this paid me eighty-four cents for raw corn, and one dollar and sixty cents for cooked."

Seven years later the same man wrote Mr. Emerick: "I have had considerable experience in cooking food for stock. I do not consider it of any increased value for cattle, but think that in warm weather or with warm pens in winter there is a saving of about one-third the grain when fed to hogs, but the

pork is soft. I first used a Prindle steamer, then an Anderson, the latter costing me one hundred and sixty dollars. I used it two years, and was obliged to throw it away. I am done with all fancy implements. At present prices of corn and pork I find clover and whole corn best, except for sows and pigs, and I feed them slop made from ground feed."

Still another gentleman, Mr. H. P. Beattie, of Davenport, Iowa, wrote to Mr. Emerick in response to his letter of inquiry on the subject of cooking food for hogs. He says: "I have cooked or steamed corn for hogs for four years. My hog-house cost me nearly one thousand dollars, and the pens are so arranged that I can keep them perfectly clean. The hogs are allowed to go out for water to runs where there is clean gravel, and the pens are swept every day. I have a steam-engine, corn-sheller, mill, vats, and every convenience that money can buy, and I have come to the conclusion that there is no advantage in cooking food for hogs. I have now large casks for souring slop for hogs, so arranged that I can pump water into them. I start with three or four bushels of fine meal and water enough to thin it, stir every day, and when it sours begin feeding, and by the addition of meal, water, and the house-slops keep it in the right condition. I find it an advantage to put some flax-seed into the slop, as I think it keeps the hogs healthy. I find this better than any cooked food."

Mr. Emerick says: "When I began this investigation I was under the impression that steaming food for farm stock could be made quite profitable, and I have pushed these inquiries solely with a view to determine whether I would introduce the business on my farm, without expecting at all to prepare this paper for the public, and now in summing up the matter, by making a careful estimate of the character of the testimony, I come to the conclusion that the margin of profit is too small to induce me to undertake it."

A series of experiments were conducted for nine years (1870-1878 inclusive) at the Maine State College. Four pigs were fed each year, two eating raw meal while the other two were eating cooked, the same quantity of meal being given in

each case. The pigs were weighed at the beginning of the experiment and at the end of each week while it continued. The experiment continued several months each time it was conducted. Great care was taken in selecting the pigs, in order to secure uniformity, and to avoid error as much as possible. The pigs were changed about so that those at first getting raw meal received cooked, and *vice versa*. Excepting the first year the cooked meal was fed cold. The results for nine years are as follows :

1870, value cooked meal to value raw meal as,	. 95.5 to 100
1871,	74.8 to 100
1872,	82 to 100
1873,	91.6 to 100
1874,	98.8 to 100
1875,	72.3 to 100
1876,	88.8 to 100
1877,	64.2 to 100
1878,	78.5 to 100
Average for nine years,	83.3 to 100

These figures are from the report of the Maine State College for 1878.

It is a matter of surprise that in not a single instance during these nine years did the pigs fed on cooked meal gain as much as those fed on raw meal. With the single exception of potatoes, I do not believe that it will pay to cook food for hogs, and large experience in feeding both cooked and fermented slop leads me to believe that the former has no advantage over the latter, while it requires expensive fixtures and extra labor. I do believe in warm slop for nursing sows and young pigs in cold weather; but would not advise any expensive apparatus for preparing it, as I have already shown how it can be done cheaply in summer or winter.

Green Food for Hogs.—While corn is the staple food for hogs we can not produce cheap pork on corn alone, and no farmer is prepared to raise hogs largely and economically unless provided with good pasture, with abundant water, and shade. I have little doubt that long-continued corn feeding is one great cause of reduced vitality and predisposition to disease which has made the raising of hogs so precarious during the last quarter

of a century. The hog in a state of nature lived during the larger part of the year on coarse, fibrous food. In summer he ate the various grasses, and in the winter mast, roots, and grubs, and his life was one of constant activity. It is little wonder that disease and loss has followed from the change to corn feeding and close confinement.

As with cattle so with hogs, much cheaper meat can be produced by grass than corn, but in the case of the hog there is a matter of still greater importance, and that is that a hog that has been on pasture without any grain for a few months is in a much better condition for fattening than one that has been fed some grain through the summer. Among our large hog growers this matter has been repeatedly tested, and it may be considered fully settled, that when a hog is not to be fattened till the new crop of corn is ready to feed, it is better that it should have no corn through the summer. The bulky diet distends the stomach, and bone and muscle are built up rather than fat, so that when the animal is put on a corn diet it will make a much greater gain than one will which has been fed grain through the summer. Some experiments have been made with hogs confined in pens, one lot being fed in summer on corn-meal alone, and another with meal mixed with cut clover; and again in winter when clover hay was cut fine and mixed with the meal for one lot. In both cases the gain from the lot to which the clover was fed was much the greater. Mr. Coburn, in his book on hogs, claims that an acre of good clover will, when fed to hogs, produce nearly one-third more pounds of pork than an average acre of corn, but I doubt very much whether the claim can be sustained; but even if it will produce half as much it would be much the cheaper food, as it grows without cultivation and the land is greatly improved by the crop. The hog will also gain faster and feed at a profit for a longer period after summering on clover than on corn.

I would advise that hogs never be turned on clover till it begins to blossom, and as this is usually not till late in May, to lengthen the pasture season we need some earlier crops, and for this purpose we have two excellent plants—rye and blue-grass.

I think it will pay every hog raiser to grow rye for early feeding. In its early stages of growth it is succulent and nutritious, and will come on some weeks earlier in spring than any other green crop. I have known cases where a herd was unthrifty and the owner feared cholera, when a run of two weeks in a rye-field in November removed all symptoms of disease and started them into a thrifty growth. A rye-field may be pastured till the blue-grass is ready, and then will make a fair crop, which may be "hogged down" or left to cut. Blue-grass in its early stages, or as long as it is kept fed short, is, I think, equal to clover for hogs and better for brood sows. In fact, our best breeders will not turn sows with their litters on a clover-field, as the heavy dew drenches and chills the pigs and injures them. When the clover blossoms, the hogs will make their living on it until corn is ready to cut up.

In the chapter on fencing I refer to the fact that allowing hogs to run at large on the farm involves a heavy expense in fencing. It seems to me that no other farm stock could be so easily provided with green food in the pen or barn-yard as hogs. They are not fastidious, like cattle, refusing to eat food which is a little soiled, and a large number of them can be fed on a small spot. Fifty or more hogs could be confined in an acre lot, and fed on the product of a small amount of land, and for their maintenance we have quite a variety of crops that could be easily grown and handled. I should recommend rye for the first and earliest feeding, and should begin to cut it as soon as I could mow a fair swath and before the heads appeared. Clover and oats would follow, and all these crops would, if cut early, give a second cutting. I would also experiment with field beets, peas, and sorgo. The beets I would drill thick in the row on rich land and give thorough cultivation, but would grow them with reference to tops and not roots, and would pull and feed them entire. Peas might be sown broad-cast or in drills, but should be on rich, clean land. Sorgo, when grown for this purpose, should be sown in drills much thicker than if to be manufactured. For later feeding I doubt if any other crop would produce as much valuable food as sweet corn, and I would

recommend the Stowell Evergreen as the best variety. It will bear much closer planting than field-corn, and a majority of the stalks will produce two ears. It remains a long time in good feeding condition, and I have long been of the opinion that an acre of this corn would produce more valuable food for early feeding than any of the large field varieties. Pumpkins would also be found a cheap and valuable food for hogs managed on this plan.

One advantage of this method of managing hogs would be that the land could be made to grow two or more crops. For example, the rye could be cut twice, and then plowed under and planted with pumpkins or sweet corn. By taking out alternate rows of beets, sweet corn could be grown as a second crop, and the clover, after furnishing a cutting, could be plowed under, and put in a later crop. I plant for family use more or less of Stowell corn each year as late as July 4th, and rarely fail to have roasting-ears from it for two or three weeks before frost. This corn will make profitable green food for at least two weeks before it is ready for the table. A succession of crops of this kind would enable the farmer to feed a large number of hogs from much less land than is now required, besides saving fences.

There is no other stock that can be so easily soiled as hogs, for in rainy weather they can be fed corn or ground feed, and will not suffer from the change.

Winter Care of Hogs.—Whatever system of management is adopted, some hogs will need to be wintered on the farm; for even if we grow only spring pigs, and market them the coming fall, the breeding stock must be wintered. There are a few simple rules which should be observed in the winter care of hogs, which will go far towards insuring success.

1st. There should not be too large a number of hogs kept together.

2d. Large and small hogs should not be wintered together.

3d. A suitable bed must be provided.

4th. Some attention must be paid to the food, to see that they have sufficient variety and some bulky food.

I have often seen thirty or more hogs, varying in size from three hundred pounds down to fifty or less, allowed to eat and sleep together during the winter; and the large ones would get more than their share of the food, and at night would either overlay the smaller ones or crowd them out in the cold. It is not uncommon, on a cold, frosty morning, to see a lot of hogs come out of a damp bed, where they have been huddled all night, the outer ones suffering with cold and the inner with heat, and in the cold air they will steam like a furnace. Little wonder that with such management disease and death ensue, and the owner finds hog-raising unprofitable.

The bed for hogs must be both dry and clean if we expect them to thrive, and to insure this it is necessary to have a floor, and to have it supplied with litter, which must be changed as often as it becomes soiled or dusty. I have used corn-fodder for a bed for hogs for several winters, as I find that they will eat the blades and husks, and tear the stalks into shreds, so as to make a very good bed, and one that will keep clean much longer than straw. I like the plan of having the hog-house adjoining the barn-yard, so that the hogs can run in the barn-yard, and if this is kept littered as it should be there will be no mud for them to carry into their sleeping-place.

I think it necessary that fall pigs have special care in winter. They should always be kept separate from the older hogs, and given warm slop. It is also a matter of importance that they be fed regularly, and only what they will eat clean. I have never succeeded in keeping hogs thrifty and growing when fed so much that soiled corn was to be found in the pens at all times or swill left to freeze in the troughs. With proper care and watchfulness there is no difficulty in keeping the stock hogs thrifty and growing through the winter.

I have in the cattle chapter spoken of the economy of having hogs to follow the cattle in winter. I find that every feeder who has had experience in this plan testifies to its profit, and I can recommend the plan to farmers with great confidence. Feed your cattle liberally with corn, and provide two hogs to follow each one, and your cattle will come through the winter in good

condition, and your hogs will grow and thrive at but little expense.

Fattening.—As “the chief end” of a hog is to become fat, and the price he will sell for depends in a great measure on the degree of fatness, it becomes a question of importance to know when and how we can best fatten our hogs. Probably no rule can be laid down that will be best for all farmers to follow, but each should decide for himself what is the best for him.

The plan of fattening spring pigs for a fall or winter market has much to recommend it.

1st. It enables the farmer to realize sooner on the capital invested, illustrating the proverb that the “nimble sixpence is better than the slow shilling.”

2d. We can make cheaper meat from a young animal than from an older one. A certain amount of food must always be expended in supplying the waste of the system, and the more we can hasten the maturity of an animal the less will be the amount of food expended in merely supplying the waste. Even if a pig weighed two hundred pounds at nine months old and four hundred pounds at eighteen, there would be a greater profit in selling at the first than at the latter period at the same price per pound, because it would take much less food to produce the first than the last two hundred pounds. The fact, however, is, that it is easier to make a pig weigh three hundred pounds at nine months old than five hundred at eighteen, and yet the hog must consume much more food during the second period than the first period.

3d. As there is always more or less risk of loss from disease, the shortening of the period of feeding will correspondingly reduce the risk.

How shall pigs be managed so as to make them large and fat enough to bring a good price in the market at nine months old? In the first place, you must have a good breed. It matters but little by what name it is called; but the hog must be one with a predisposition to early maturity, with a good constitution and digestive organs. Fortunately, we have several breeds that combine enough of these points to make them ex-

ceedingly valuable to cross on selected mothers from our common stock.

Next, we must give them good care. If the pig is neglected and its growth checked the chances will be very much against it. I have already said that the food for the first four months should be such as to contribute to growth of bone and muscle, rather than fat. Slop and grass, with moderate corn feeding, is better than all corn. During the three months succeeding weaning there is no food that will produce so good results as milk, and even a small amount of it mixed with bran and corn-meal will be found of great benefit. I believe also, at this period of growth, that bran is worth more, pound for pound, than corn-meal, and would recommend that at least two bulks of bran to one of corn-meal be used. I also place a very high feeding value on potatoes for this purpose. A peck of small potatoes, that can be boiled on the cooking-stove while the family are at breakfast, and mashed in the slop-pail, will flavor twenty gallons of slop so as to make it nearly as palatable as milk; and, if the bran and meal are added at the same time as the potatoes, in a few hours the mass will be found rising as though bakers' yeast had been used. If mixed every morning, this slop will not be too sour in the hottest weather.

If any one objects that this is too much trouble, I have only to say that success in any branch of farming is to be attained only by care, pains, and labor, and if we can make pork for one or two cents less per pound, it is profitable to do so.

Professor E. W. Stewart, in the *Rural New Yorker*, writes on this subject so much in accordance with my views, that I quote his article entire. He says: "The science of feeding animals is becoming much better understood, and the best feeders are fast changing their ideas of the proper management of young animals. It is not long since pig feeders thought a slow, early growth the best for the constitution, and even the profit of the feeder. This was carried to such an extent that pigs were not ready for market till eighteen to twenty-four months old, and it was thought desirable to reach a weight of four hundred to six hundred pounds. The storing system, or suspended growth,

was almost universal. Pigs were kept over winter with little if any increase in weight. The feeders did not seem to discover that this food given to store animals was even worse than lost, for the animals took on an unthrifty habit, contracted their powers of digestion, and required, in spring, nearly a month of good feeding to recover from this penurious winter feeding. A thrifty animal, with good management, progresses without check from its first to its last day. When a little attention was given to the matter, it became evident that the profit of growing meat was to be found in pushing the young animal as rapidly as possible, that it cost the least to produce a pound of growth in the earliest period of life, and this cost in food grew proportionately greater as the animal increased in age and size. This, then, is the great fact underlying all successful feeding of young animals.

“Experiments were tried in 1866–68, at the Michigan Agricultural College Farm. In the first, three, and in the last, six pigs were fed upon milk. The pigs were from four to six weeks old at the commencement of the experiment. The average amount of milk required to produce a pound, live weight, was: First week, 6.76 pounds; second week, 7.75 pounds; third week, 12.28 pounds; fourth week, 10.42 pounds. Professor Miles says the cause of its requiring a greater amount of food the third week is explained by a ‘derangement of the digestive organs during this week, as shown in a tendency to constipation.’ He calls attention to the fact that ‘the milk to produce a pound of live weight constantly increases.’ After ending the experiment in 1868 on milk, he continued it upon corn-meal. Pigs and food were weighed as before, and the feeding continued twenty weeks, divided into five periods of four weeks each. Amount of corn-meal required for a pound live weight was: First period, 3.81 pounds; second, 4.05 pounds; third, 4.22 pounds; fourth, 5.24 pounds; fifth period, 5.98 pounds. Another experiment was tried in 1869 with a larger number of pigs, with nearly the same result, in regard to amount of meal required to make a pound of live weight, and showing, practically, the same increase in the food required to make each additional pound live weight as the pigs grow older or heavier.

“The point here illustrated is of the highest importance, and should be carefully studied. It will be seen that in the fifth period, when the pigs were from twenty-four to twenty-eight weeks old, it took seventy-five per cent more of meal to put on a pound live weight than in the first period, when the pigs were eight to twelve weeks old. In 1874 the writer tried an experiment with ten calves upon skim-milk, running through twelve weeks, in which the milk for each pound of gain increased from 11.02 pounds the first week to 17.01 the last week.

“That most pains-taking experimenter, J. B. Lawes, of Rothamsted, England, has also settled this question in the same way, proving conclusively that all profitable feeding of animals for human food must be made before the animal reaches maturity.

“These facts all point to the importance of feeding the young pigs in the most liberal manner. Some breeders think it quite sufficient to stint the pig to the milk of the dam, and thus seldom give any extra food to even a litter of ten pigs. But such breeders have not estimated the amount of food required to feed a thrifty litter of eight pigs. Pigs, at birth, seldom weigh more than three pounds each, and when four weeks old should weigh fifteen to eighteen pounds each, and must, therefore, gain twelve to fifteen pounds each, which is an aggregate gain of say, one hundred and twelve pounds. This requires the sow to yield milk enough each day to produce a growth of four pounds live weight; and the production of milk by the sow weighing, say three hundred pounds, equal to that of a cow weighing eight hundred to one thousand pounds. How important, then, that the pigs should be taught to take food very early.”

On this subject of the management of pigs that are to be fattened the first fall, I find in the *Ohio Farmer* the following, which I fully indorse: “Feed regularly. I do not mean by this simply at stated hours of the day, but that the feed should be as nearly as practicable uniform in quantity and quality. It will not do to feed lightly to-day and heavily to-morrow, to give them bran one day and all the corn-meal they will eat the next. Try to so manage that while giving a variety of feed of a given

bulk, enough to fill their stomachs, of the different kinds, it shall contain nearly equal amounts of nutriment. Irregular feeding, or sudden changes of feed, are almost certain to bring on diarrhœa in pigs, resulting, if not in the loss of pigs, at least in loss of weeks of growth.

“For their own good and as a relief to their mother let the pigs be taught as soon as possible to get a part of their living independent of the mother. They will learn at a very early age to drink milk if furnished in shallow troughs. As soon as they take this readily, a little scalded shorts, oat-meal, or even corn-meal, may be added, and the quantity gradually increased until you have a thick slop. As soon as well accustomed to it, give them all they will eat, and in addition let them have whole corn and oats. They appear to take delight in cracking and eating the grains. The small, unsalable potatoes, if not used up in the fall, may now be utilized to good advantage by boiling and mixing with the slops and fed to either the sows or pigs. Furnish good, clean, dry, warm quarters, and if well-bred pigs, they will grow rapidly.

“The three requisites of good management from this time till ready to begin fattening, are plenty of good feed (a large portion of which is to be grass), shade, and water. They are to be kept growing without getting them too fat. There is little danger, however, that they will become too fat. Too many mistake good or high condition for fatness, especially in the *well-bred* hogs.”

The following experiments show the gain made from feeding milk alone to pigs. “On May 1st I took four Yorkshire pigs, weighing one hundred and twenty pounds, of an average weight each of thirty pounds, being just two months old. I fed them on clear skim-milk, with no grain or refuse food whatever, till June 1st. The milk was soured, and fed three times a day. They consumed seven hundred and five quarts of milk, and gained ninety pounds, or twenty-two and a half pounds each. Reckoning the gain in weight as worth eight cents a pound, gives us an increase of \$7.20, or about one cent a quart for the milk consumed, making no allowance for the manure.

“To learn the value of sour milk for feeding pigs, I weighed three pure-bred Berkshire pigs, about seven weeks old, and fed them for ten days. They weighed one hundred and four pounds. I fed them five hundred and twenty pounds of sour milk, and then weighed them again. They had gained thirty-five and one-half pounds, showing that less than fifteen pounds of milk had made a pound of live weight of pork. I was surprised to find so large a gain in the weight of the pigs for so small an amount of milk.”

In my judgment, milk fed in connection with other food would, by increasing its digestibility and making it more palatable, be worth much more than it would when fed alone. A slop made with one gallon of milk to eight or ten of bran, meal, and water will be eaten in larger quantities and will be less likely to produce indigestion than any slop that can be made from meal and water alone, and our object in fattening a pig is, not to see how cheaply we can keep him, but how can we get him to eat and digest the most feed.

While there can be no question that the cheapest pork can be made by feeding good spring pigs for a fall market, it is obvious that this system can not be adopted universally, for several reasons: 1st. The market demands more or less hogs at all seasons of the year. 2d. The cattle feeder wants thrifty stock hogs to run with his cattle in winter. 3d. It is often the case that from unusually bad weather, or some other cause beyond the control of the farmer, he loses his spring pigs, and must breed for a second litter or do without hogs; or in cases where the farmer has adopted the plan of getting two litters a year from his mature sows. 4th. On farms where large numbers of hogs are kept it is difficult, if not impossible, to take such care of the pigs that all can be profitably made ready for market the first fall, and with many farmers who wish to clover their hogs through the summer it is not desirable.

On many farms both systems of feeding might be followed. The sows could be bred to come in early in March, and the best and thriftiest of these pigs fed for a December market, and the lighter pigs and the September litters fed to be sold at an earlier period the next year.

To make the cheapest pork from these hogs they should be fattened in late summer or early fall. If the farmer provides rye or blue-grass pasture—or better both—he can lengthen the grazing season so that his hogs will be in good condition for feeding by the middle of July or first of August. The clover-field is the best place to feed them, provided they can have a good supply of pure water and shade. The latter can be cheaply provided by temporary sheds covered with brush, straw, or clover. The advantages of feeding in the clover-field will be that the hogs will still eat enough clover to keep their digestive organs in good condition, so that the change of diet will not be too sudden or radical. The clover-field will give a clean place for feeding, and by choosing a new spot every day or two you will not only avoid mud and dust, but will be able to enrich the field more evenly. The most convenient crib from which to feed hogs in the field is an old wagon, a thing which can always be bought cheaply at a farm auction. A load of corn can be placed in the old wagon and fed out on all sides of it, and then the wagon moved to a new spot. I recommend that corn be fed moderately for a few days, but would get the hogs on full feed as soon as prudent.

As soon as new corn is past roasting-ear stage begin feeding some of it cut up, but keep up feeding with old corn. It will pay the farmer who expects to feed at this season of the year to grow enough of some early variety of corn to supply his hogs for two or three weeks; and although I have not fully tested the matter, I think one of the large varieties of sweet corn would be more profitable than field corn for this purpose. Either Stowell, Evergreen, or Mammoth is earlier than field corn, and will bear considerably closer planting, and yields two ears on most of the stalks. If feeding begins earlier, and the hogs are to be sold before the new crop of corn is ready for feeding, it will pay to feed some slop, as heavy corn feeding in hot weather will not produce as good results as a more varied diet. The hogs will eat and gain more and keep in better condition if some bran is fed in the slop. Hogs of suitable age and a good breed that were in good flesh when turned to pasture in the spring

can be fitted for market with quite a short period of summer feeding.

When you do begin feeding, I advise that you push and get as much gain as possible, and at the same time watch the markets closely. I have known profitable sales made after a very short period of feeding, and often by holding a little too long a drop in the price takes all the profit from several weeks' feeding.

Keep salt and ashes before your hogs all the time when fattening them, and if you can buy charcoal feed them what they will eat of it. Our best feeders buy a wagon-load of it at a time.

Even when hogs are to be fed for a December or January market it is best to begin early as the green corn will do to feed, for it has been demonstrated over and over that pork can be made much cheaper in warm than in cold weather. I have before me the report of a lot of hogs that were put up to feed in October, when the weather was warm, and the gain they made paid eighty cents a bushel for the corn. The first week in November, the weather being colder, the gain paid sixty-two cents per bushel for the corn. As the cold increased the gain grew less, and the last week in November the gain paid but twenty-five cents a bushel for the corn. Another lot was then put up, and during December the gain paid just twenty-five cents a bushel for the corn consumed. The middle of January the weather grew colder, and another weighing showed that the gain paid only five cents a bushel for the corn eaten, and the week following, with mercury ranging to ten degrees below zero, they made no gain whatever.

How much Pork from a Bushel of Corn.—There have been many and long-continued experiments made to ascertain how much gain can be reasonably expected from a bushel of corn when fed to good stock, under good management, and the average is found to be not far from ten pounds. This estimate does not include the corn fed in rearing the pig, but only that fed during the fattening process. At ten pounds per bushel it is very easy to calculate what we are getting for our corn, as each cent a pound for the pork represents ten cents a bushel for the corn.

In exceptional cases on record a considerably larger gain has been made, but usually for only a short period, and it is safe to assume that it will take both good stock and good management to reach this result. It also shows the importance of making as much of the growth of the hog as possible from cheaper food than corn, and of getting his system into the condition that will enable him to make the greatest gain while on a corn diet, of pushing the fattening process as rapidly as possible, and selling as soon as the point is reached at which the gain does not pay for the corn.

The facts connected with profitable pork production may be summarized somewhat as follows:

1st. The profitable production of pork requires good stock.

2d. Good stock calls for good care, and only the careful farmer will make hog-raising profitable.

3d. As a large per cent of the food goes to supply the animal waste, the shortest period in which we can get our hogs ready for the market will ordinarily give the greatest profit.

4th. An exception to this rule will be found where hogs are wanted to follow cattle or to consume clover.

5th. Grass or other green food will enable the farmer to produce much cheaper pork than corn alone.

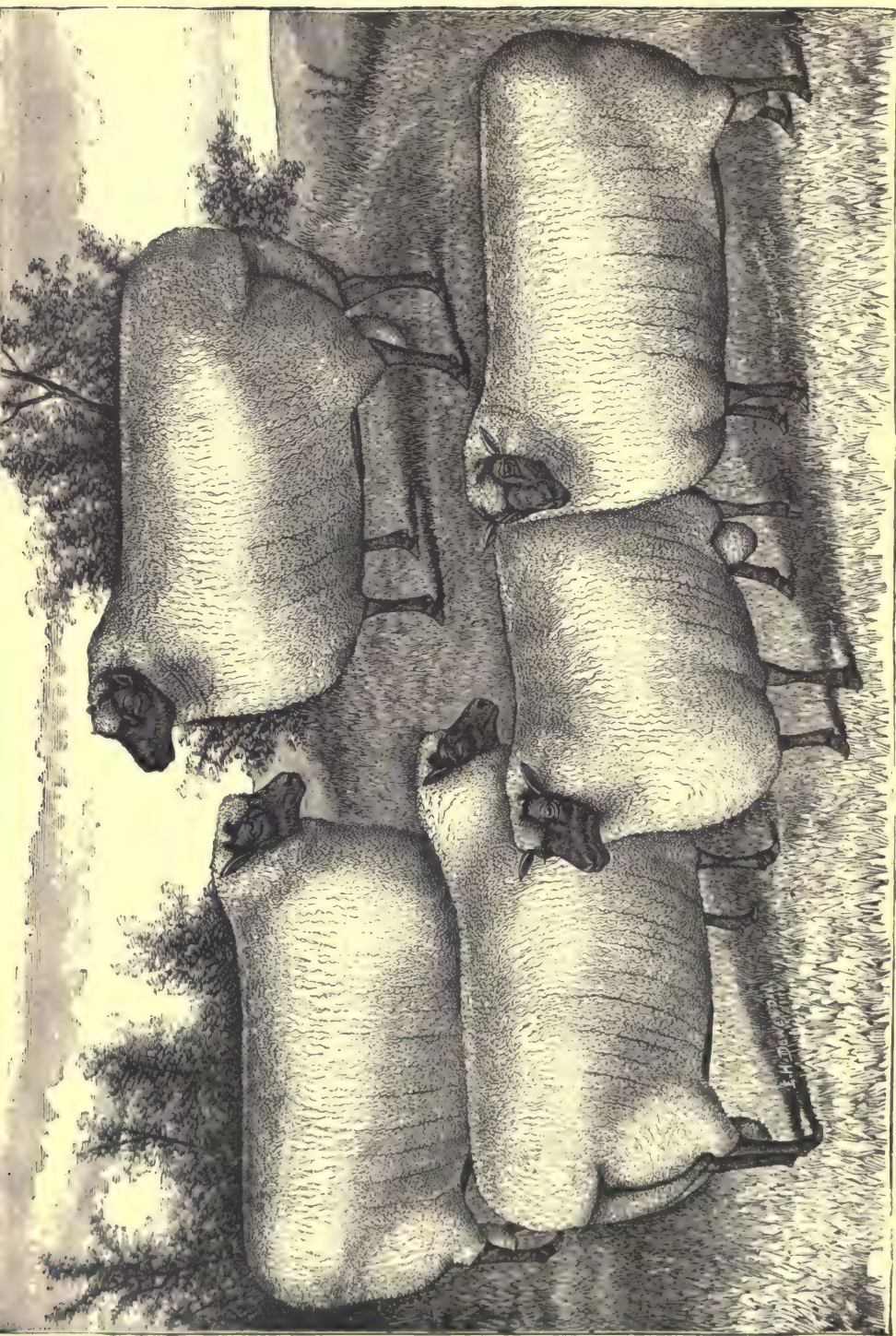
6th. A greater gain can be made in a given time from feeding slop with corn than from corn alone.

7th. It costs much less to make a pound of pork in warm than in cold weather.

The Hog as a Manure Maker.—Manure produced by fattening hogs is valuable because it is so condensed. Corn being a rich, concentrated food, the manure made from it is of the same character. I conceive the great value of the hog as a manure maker to be, however, not so much on account of the richness of the product as from the fact that he can be made to work over crude material and reduce it rapidly to a condition in which it can be used. In the chapter on manures I tell how to use hogs in the barn-yard to rapidly reduce corn-stalks and old straw-stacks to a condition in which they can be used even as a top-dressing before the wheat-drill. Any farmer who will test

this matter will find that the labor of turning and fining can be reduced at least one-half by a judicious use of hogs in the barn-yard. I find, also, that when hogs are confined, and furnished, as I recommend, an outside floored pen, they can be made to work over waste material, such as corn or broom-corn stalks, sawdust, potato-vines, or the coarse bedding from the cow or horse stable, and get it into a condition for use quicker than in any other way; and I estimate that hogs will half pay for their keeping in this way. They will reduce in a short time the coarsest material to a condition in which it can be forked into a heap to rot, and at the same time will thoroughly mix with it their rich droppings.

It is an excellent plan to wheel the manure from the horse and cow stables, and dump it where the hogs can be allowed to run, and once in two or three weeks fork the contents of the outer pig-pen on to the heap. A pig-pen can be kept free from offensive odors in this way, and all the manure will be improved in quality, as the horse manure is so heating as to be in danger of loss by too active fermentation, while that of the pig and cow is of a cold, sluggish nature.



CHAPTER XVII.

SHEEP.*

OF the various breeds known to man, the reader is practically interested only in the English and the Spanish, in their different varieties. The English breeds are, first, the long-wooled, comprising the Cotswold, Leicester, and Lincoln; second, the short-wooled, the South-Down; third, the middle-wooled, as the Shropshire, Oxfordshire, Hampshire—all of which are known as Downs, but were originated by crosses between the Downs and the long-wools, and partake of the qualities of one or the other ancestor in proportion as either was preponderantly employed in the several crosses. They are all considered pure breeds. Some of them approach very near the long-wools in length of staple; others, the short-wools. The long-wools are pre-eminent for a long, coarse staple; the short-wools, for mutton; and in the middle-wools the object has generally been to combine these excellences.

The Spanish Breed, the Merino, is the source from which have sprung, through the influence of climate and the molding hand of man, a number of sub-breeds—the French, Saxon, Silesian, American (with a variety known as the Delaine or Black-top), and, possibly, the Australian. The Merino, tracing its descent back in a direct line, probably to the flocks of the Patriarchs, was for ages the clothier of civilization—first with its skin, in later times with its fleece. So long as that civilization was confined mainly to the sub-tropical belt of Southern Europe, the adaptability of this breed to the vast unenclosed ranges of those lands, and the careless husbandry of those times, rendered it almost, if not quite, the most valuable of the domestic animals. Its long descent gave it a purity, a

* Contributed by STEPHEN POWERS, Author of *Sheep Experience Papers*, etc.

prepotency, and a hardiness which have projected it into other climates and other civilizations, where the constantly increasing density of population created a demand for meat and a long staple, which the Merino could not always furnish to the best advantage. Hence the claim of the advocates of the English breeds that they are the accompaniment and support of a higher civilization is not perhaps wholly unjust.

Still, after the most liberal concessions are made to its great competitors, the Merino undoubtedly holds the first rank yet, both in number and in economic importance. Notwithstanding a century of acclimation and wonting to Anglo-Saxon thriftiness in farming, the Merino still retains many of the characteristics stamped on it by two thousand years of Oriental unthrift. It is an industrious and roving feeder, impatient of restraint, loving nothing so well as the hilltops and wide expanses. To sum it all in a word, the English breeds are the sheep for the small farm, and the Merino for the poor farm. On the great plains of Texas, California, and Australia the Merino returns with satisfaction and with profit to the owner to its habits in Spain, which were more or less migratory.

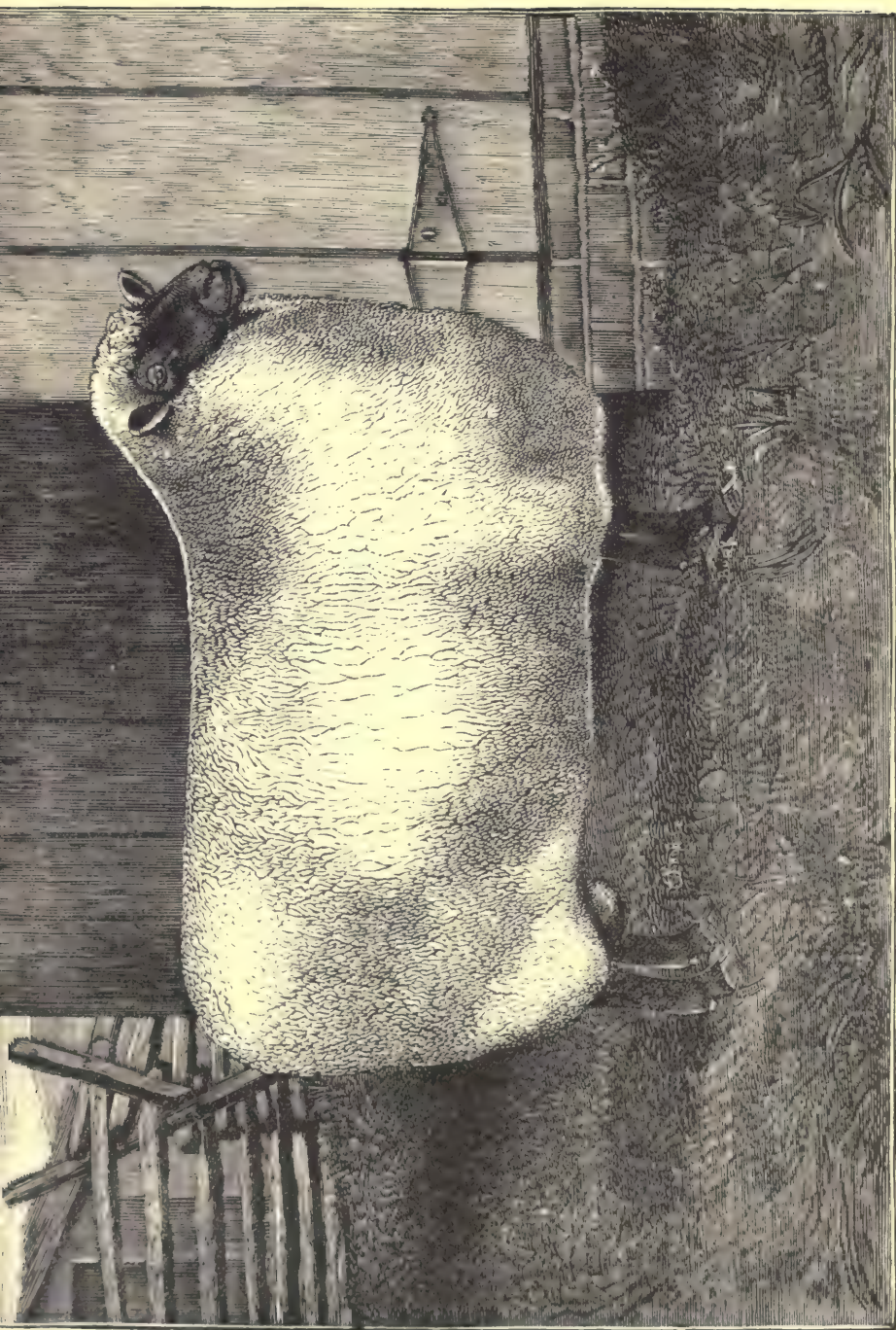
In considering which breed would be most profitable for himself the farmer must take account, first, of the qualities of the sheep themselves; second, of his farm and surroundings. No manufacturer's advice is likely to be of much value, for he will almost invariably counsel the production of that class of wool he himself requires. Neither need the flock-master debate long over the particular class of wool he shall produce with abstract reference to its selling qualities (not, however, that any one should engage in the growth of a coarse carpet wool which can be grown profitably only in a semi-barbarous society), for in these days of rapid transportation it may be set down as an axiom that every civilized country furnishes *somewhere* a good market for every kind of wool. And wool will keep until the location of that market can be found.

All sheep do best in a climate which has sufficient equable rainfall to keep the fleece mellow, not subject to extreme changes, especially changes from dampness to severe cold, and

where the soil is porous enough to absorb that rainfall, free from swamps and marshes. The English sheep are more tolerant of moisture than the Merino, less subject to foot-rot. All sheep had better be wet in the fleece than on the feet; they should have dry flooring at all hazards. The Leicester is perhaps best adapted to low grounds—if these *must* be employed—is somewhat more sluggish than the Cotswold, not so hearty a feeder, the equivalent of the Jersey and the Holstein. The Cotswold has been not inaptly compared to the lordly Durham. English shepherds hold that their own distinctive breeds achieve the highest sum total of results where bred with sole reference to mutton; and the production of mutton requires a rich, succulent herbage, lasting many months of the year. Hence the sheltered milder slopes of the Atlantic Coast and on the Pacific coast, a strip comprising Humboldt and Mendocino counties in California and Western Oregon, Washington and British Columbia, are indicated as a propitious climate for the British breeds.

Mutton.—To the great majority all kinds of mutton are alike, provided the age, general condition and methods of butchering are alike. But there is no doubt that the chalky downs of Dorset, and the limestone pastures of the blue-grass region (home of the Improved Kentucky), furnish the finest mutton known. But the crowning point in the superiority of the English mutton breeds over the Merino is their precocity. And it is simply a truism to say that the flesh of a young animal is better than an old one. Hence a Cotswold lamb which will furnish forty-five pounds of dressed meat where a Merino of the same age will yield but eighteen or twenty is the more profitable, even though it may have consumed thrice the amount of feed.

Neither need the farmer be deterred from entering upon the more strictly meat-producing branch of sheep husbandry by considerations of distance from market if his soil and climate are specially adapted. When Kentucky can send twenty thousand sheep in a year to the single city of Boston, and sell them at six cents a pound while New England mutton is selling at four, there is little danger in growing good mutton anywhere. Merinos for the granite hills of Middlesex, and Cotswolds or Downs



for the rich limestone pastures of Bourbon County, would be the dictate of a sound business system, notwithstanding wool is so much more readily transported than mutton.

The feeding of animals for the shambles requires a higher and more artificial system of management than the growing of wool; hence the former class of sheep need to be kept in smaller flocks, that they may be more closely watched and more carefully handled. The English breeds are wholly unfit for unfenced ranges; they scatter and make herding extremely difficult. In fenced enclosures there is a natural limit to the number that should be kept together, which is determined by the capacity of the pasture, whatever the breed. Cotswolds and Leicesters desire to be spread out separate and quiet; Merinos keep in bands, but travel; hence they would tread down and waste the rich pasturage suitable for the heavy feeders. All breeds alike are impatient of close housing, and it is difficult to say whether one is injured more by it than another.

Referring to climate once more, I may say that the Merino will endure a sudden removal across many degrees of latitude better than the English sheep, though all sheep, like the human race, do best when emigrating on climatic parallels. The English breeds bear transportation to a cold climate better than a hot one. They do well when carried from England to the rigorous winter of Canada, but when brought suddenly to the sweltering summer of the Ohio Valley they wilt and perish under the dry heat. The Merino, like the Andalusian cow of Texas, has some of the old wildness and sun-fever of Spain in its blood yet, and is not so good a nurser or milker as the gentle large-uddered Cotswold. It can take care of itself better than the latter, endures hardship better, but does not take so good care of its young.

British sheep husbandry is based upon rape and turnips, what might be called open-air soiling with a system of movable hurdles, depositing the invaluable sheep manure directly where it is wanted, covering an acre or half acre at a time. Their moist climate and mild winters enable them to produce from these vegetables an enormous quantity of herbage, rendering

their mutton tender and juicy; then with their mellow, shade-cured hay (not sunburnt like ours), with oil-cake, oats, and other rich nitrogenous feeds, they make it fat, well "marbled" with lean, as in the South-Down, and fit for an epicure.

The rigorous winters and the dry hot summers of the United States render this system more or less impracticable here. On the Atlantic slope, where corn is less thrifty, and where English custom and precedent have more influence, the growing of these vegetables and roots has been engaged in to some extent, but not with eminent success. But in the Mississippi Valley the foundation of all husbandry is, and probably will always be, that prolific and sufficient plant, Indian corn. The leafage and grain taken together furnish an almost perfect ration, even for sheep. But of this more further on.

On the Atlantic slope, with the exception of limited areas, as in Vermont, etc., the production of wool and mutton is an entirely subordinate industry, owing to the fact that it is a region very much superior to others devoted more largely to wool-growing in requisites necessary to success in mixed farming. And this fact makes it creditable to sheep that they retain as permanent a foothold as they do there. The breeds of sheep are perhaps not as well defined or as highly improved as in the West; there lingers a greater proportion of the old native American stock, described by Youatt as being a sort of mongrel scrub Leicester, mixed with South-Down and Cotswold.

The limited product of grain and the greater cheapness with which it can be produced in the West render it too high-priced to be given to sheep in any quantity. Eastern farmers endeavor to winter their stock or breeding flocks without grain—on clover hay, chaff, pea, bean, wheat and oat straw—thus making them serve as scavengers or consumers of refuse products. This for the reason that there is a cash market for nearly every thing, even rye and wheat straw. A prominent object with them is the growing of early lambs for the market. They buy ewes shipped from the West, generally those which have passed their prime; rangy, good-sized, open-wooled grade Merinos; on which they cross a South-Down or Cotswold ram two years old or up-

wards. The earliest lambs are dropped from January 15th to February 15th; the ewes are well sheltered and fed to improve their condition, so that they generally year fine, strong, growthy lambs. When the latter are a few weeks old they are allowed access to a separate apartment, and are fed bran, meal, and ground oats in troughs. They generally bring four dollars and fifty cents to five dollars per head when they will weigh thirty or forty pounds gross. If not too aged the ewes are retained for further service; if they are, they are fattened for the fall market. A South-Down ram generally costs from ten dollars to twenty dollars. They are preferred to the Cotswold, Lincoln, or middle-wool rams, because their lambs, though smaller, fatten better, have better hams, and produce a marbled flesh.

The celebrated Merino stud-flocks of Vermont and Ohio are a specialty upon which it is not necessary to enter. The systems of the Mississippi Valley and its tributaries are based on Indian corn, timothy, hay, and fodder. The size of flocks increases as we go West. In Western New York, Pennsylvania and Virginia, Ohio and Indiana, Merinos and their grades prevail, of established breeds, though in the southern half of this region there are still immense numbers of the old natives, or "mountain rangers," whose bald heads denote a mongrel Leicester blood coming from Virginia. The Pan-handle and adjacent regions still have some large flocks yielding the superfine or electoral wools. Washington County, Pennsylvania, is the home of the Black-tops or Delaine Merinos. Western Pennsylvania and Virginia and Southern Ohio grow a plainer sheep and a longer staple than Vermont, Western New York, and Northern Ohio. Pennsylvania, West Virginia, and Ohio sheep are accounted the truest representatives of the American Merino, and their wool has long been quoted highest in the Eastern markets. But in Ohio of late years the breeding of very wrinkly and yolky sheep to cross on the coarse Mexicans of the West has somewhat debased the staple—as happened in Vermont from a similar cause—which, together with frauds and carelessness in the preparation of the clips for market, has hurt the good name of Ohio wool.

Michigan and Wisconsin fleece, long holding the second rank, is now pressing for admission to the first.

In the sub-montane district under consideration wool-holds precedence over mutton. Hay, principally timothy, some clover, red-top, blue-grass, with corn, oats, and bran constitute the staple feed. Some careful flock-masters grow turnips and fodder-corn for breeding ewes, but a vast majority depend on bran and clover-hay for a laxative. Corn-fodder is given out far less than in the West. Shelled corn is the principal grain-feed for fattening wethers, while the favorite ration for lambs and tegs is corn, oats, and bran, mixed in about equal proportions. The bulk of the wethers are shorn unwashed in March, April, and May, sold at four dollars and twenty-five cents to three dollars and fifty cents a hundred, and shipped East. Many young ewes are sent West to found new flocks; oldish ones to the East, for the use above mentioned. The flocks are washed the latter part of May, shorn about two weeks later, and the wool sold to agents, who generally receive a cent a pound commission.

The prairie section of the Mississippi Valley may be held roughly to include Kentucky, the home of the famous Improved Kentucky. Here the English long-wools are gaining a strong and permanent foothold, though there are many fine flocks of Merinos in Northern Missouri, Iowa, and Wisconsin. Sheep are here housed far less than in the Ohio Valley, not only because of the scarcity of building material, but because wool is less sought after. Corn is often given to flocks in the ear, and on the ground in a wasteful manner; they are sometimes fed with the corn unhusked; and even in the fall or early winter turned into the standing grain. They are frequently wintered in the same inclosures with cattle. In hard winters thousands of sheep are driven East from the plains to the cheap corn-fields of Kansas and Missouri, to return in the spring. In Minnesota sheep winter well on clover-hay alone; when there is none of that they receive grain. In Nebraska the maximum cost of keeping a sheep a year is placed at one dollar, from that down to sixty-five cents. Twelve tons of prairie hay, worth



A SHEPHERD OF THE OLDEN TIME.

twenty-eight dollars and twenty-cents, and two hundred bushels of corn, worth thirty dollars to fifty dollars, will winter one hundred head. A shed and racks of pine lumber for one thousand sheep will cost five hundred dollars; "a Kansas shed" of poles, hay, sorghum stalks, etc., can be built for a trifle. In Kansas, sorghum and millet are given to sheep. More are shorn unwashed than in the East (about April 15th in the latitude of Kansas City). Merinos increasingly predominate over all other breeds as we approach the one hundredth meridian and the arid plains. Scab and foot-rot are stated to be almost unknown in Minnesota. Foot-rot is troublesome in Illinois and Iowa; scab in Kansas.

The systems of the Far West, including California, Oregon, and Texas, were at first essentially vagabondizing; but are now assuming permanence. Some roving, adventurous man would purchase five hundred to one thousand ewes, generally Mexican, at one dollar to one dollar and fifty cents a head, get a mustang or two, and follow them up with tent and "chuck-box," camping where night overtook him, and resuming his wanderings in the morning. Soon the flocks crystallized about the watering-places. Frequently the pre-emption of a spring or pond or an eligible water-front gave a monopoly of thousands of acres of government land, and insured the pioneer a speedy fortune. The basis of sheep husbandry in the vast Rocky Mountain and Pacific coast region is bunch-grass, with buffalo grass as the main adjunct in the Rocky Mountains, circle and sage grass in the Utah basin, and alfilerilla and burr-clover in California. In Texas it is the various kinds of mesquite grass; in New Mexico and Arizona the grama grass. The bunch-grass is a wonderful compensation of nature in those desert and alkali wastes, curing into standing hay, nutritious as grain; but the absence of it in Texas, New Mexico and Arizona is more than balanced by the two rainy seasons of that region, and the almost unequalled grama.

In the interior of the continent, remote from all cultivation, the sole resource winter and summer is the native grasses, with some sporadic chance provision of wild hay for a hard season.

In California and Oregon many large flocks are managed somewhat in the Spanish fashion, being driven in summer to the high sierra, where there are luxuriant meadows between the double crest, or over to the vast sage-brush plateaus and river basins of Nevada and Idaho. Some flock-masters have their summer ranges, which they claim by prescriptive right, and over these they wander and camp in pioneer fashion. Little flocks of Merino rams are driven up to the flocks in September, often in the proportion of two or three to the hundred ewes, as the unrestrained character of the service is wasting and destructive. The flocks are driven down in the fall and wintered in the foothills of the sierra or the coast range or in the vast tule swamps of the San Joaquin and Sacramento Rivers. Many perish unsheltered in the cold rains and northerners of winter—more probably than in the colder, but drier interior. From ten to forty per cent of the lambs have died in a single cold rain in the Eel River Mountains. More than two-thirds of the flocks have succumbed to an occasional drought in Southern California.

Still, California and Oregon have been a hive from which bands of sheep have swarmed all over the central and northern West, even to Nebraska and Minnesota. The large, rangy California Merinos are sought as breeders on the northern parallels. Crossed with the British mutton breeds they yield excellent flesh-formers, which sell in Chicago at five dollars and a half to six dollars a hundred. Thousands of French and Spanish Merinos have been shipped by rail from Los Angeles to western Texas, to start flocks. On the Pacific coast wethers are often fattened on wheat stubble; the saying of California farmers is that their stubble must pay their taxes. Large flocks are driven eastward by slow marches until they meet the western corn; fed on this a few weeks their large grass-grown frames make exceptionally good mutton.

Wool is generally shorn unwashed—on the Pacific coast in March and April; in the interior later. Lambs are clipped in the fall. The yield is from three to six pounds per head, varying as the flock has been graded up from the Mexican originals.

The cost of shearing ranges from two cents a head (where Mexicans or Indians are employed) to six cents for good American shearers. Throughout the Territories the average estimate of cost of keep is thirty cents per head per year. In Nebraska, Dakota, and Montana (the latter is especially adapted to Merino) the cost is even lower; thirteen cents a head will cover the expense of wintering. One man often herds two thousand head alone, except in lambing time—then two or three are required to a flock. Every morning during the lambing season the flock is allowed to drift slowly away from camp, leaving behind the ewes with freshly dropped lambs. These are then removed and herded in a separate band.

Sheep are remarkably exempt from disease (except scab) in all this region. And scab can be kept well in hand by vigorous preventive treatment. This consists of a tobacco and sulphur bath twice a year, into which the sheep are dipped or, preferably, driven one by one, falling in suddenly and coming out by a long ascent, at the top of which the wool is squeezed. In Texas there is a malady locally known as "lombrieze," apparently the same as paperskin (treated further on). Maggots and the "screw worm" are a troublesome pest in hot, muggy weather in that latitude, and compel close tagging and careful watching of the flocks. The normal profit in Texas has been for some years twenty-five per cent; in exceptional cases it reaches thirty-three and a third—or falls to zero.

Sheep husbandry in the South is so sporadic and so jeopardized by the dog that, in the limited space here allowed, it can be treated only with good wishes. Maryland and Virginia (Tidewater) may be included in the Atlantic slope with the system above outlined.

In Australia, on the vast plains, sheep husbandry is prosecuted on a scale to which America can furnish no parallel. One individual in New Zealand owns 386,000; another in New South Wales 261,000, etc. A sheep-run is called a station; in all the colonies, except Victoria, it is generally hired from the government on a long lease at about ten shillings (\$2.30) per mile, with the reservation that any *bona fide* settler may choose

up to 320 acres, and pay for it in easy installments. A run is seldom less than twenty-five square miles; an average is from 150 to 600 square miles, and they sometimes exceed 2,000.

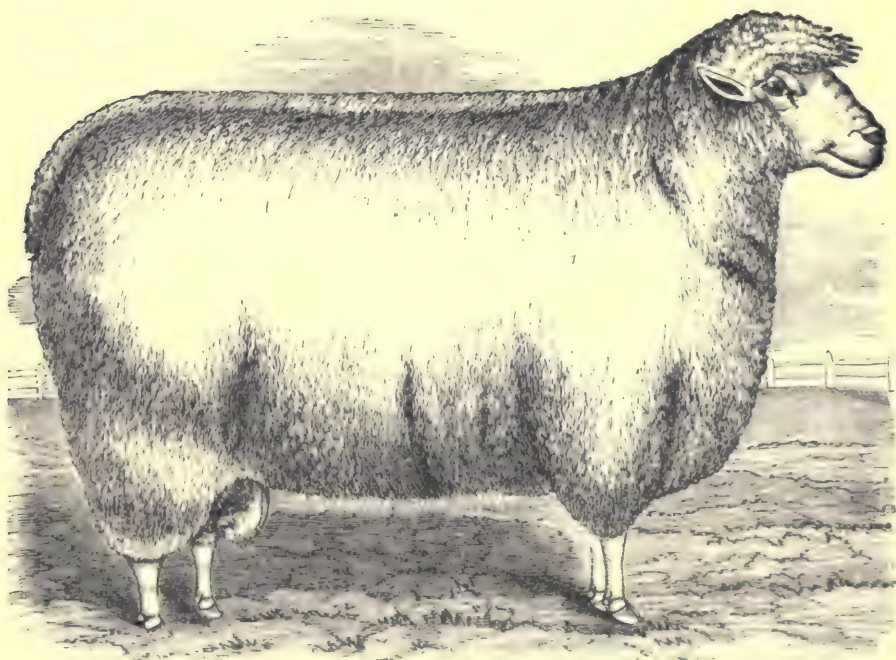
Immense tracts of territory suffer seriously from the depredations of the kangaroo, which lives mostly in the open, and of the "wallaby," which infests the "bush." These animals make their appearance suddenly in enormous numbers and consume all the grass, so that the sheep have to be driven off. The settlers make war on them by hiring bands of hunters to shoot them. As in all these arid, dusty countries, scab is a terrible plague to the shepherd. Government inspectors are appointed over designated districts, and the requirements as to the inspection of infected flocks are very rigid, though less rigidly enforced.

Shearing is done in November and December, running through both months on large ranges. Shearers are paid about a sovereign (\$5.11) per one hundred head; "roustabouts" an equal sum per week, and "musterers" six shillings (\$1.38) per day. The skirts are detached from the fleeces, leaving clear body-wool, which is loosely tied with very light twine and packed in bales of four hundred to four hundred and twenty pounds. The wool fetches in Melbourne or Sidney from fourteen to twenty-seven cents, according to grade, the former being the price of offal, while choice clips, with skirts out, bring the higher figure.

Australia fleeces average from four and a half to six pounds of unwashed wool, the fiber being generally fine, true, and sound, though an occasional severe and protracted drought makes it jointed. American manufacturers rather prefer it over domestic fleece at the same figure on account of its fine working qualities, the absence of dung and fribs in the fleeces, and the light wastage in the scouring-tub. Australian unwashed loses only two or three per cent more in scouring than American washed.

South America offers great attractions to the flock-master in some respects. For instance, in Buenos Ayres, one hundred Spanish squares (450 acres) will support one thousand sheep, while in Texas two acres are allowed to the sheep. There are over fifty-seven million sheep in the Argentine Republic. So

excellent is the native pasturage that a sheep frequently yields from eighteen to twenty-five pounds of tallow. But the government is so unstable, the native laborers so worthless, and that great pest, the scab, so prevalent and severe that the remarkable natural advantages of the country are more than overbalanced. As proof of the miserable management of the shepherds, it is sufficient to mention that the actual annual increase of the flocks is only thirty to forty per cent, while the average fleece is only about four pounds of unwashed wool, worth ten to



COTSWOLD RAM.

Property of Benson, Maule & Co., Philadelphia, Pennsylvania.

twelve cents per pound. Sheep are generally let out on shares in Buenos Ayres; the herder has one-fourth or one-third of the clip and actual increase, "finding" himself. The rent of one hundred squares (450 acres) is about two hundred dollars in gold per year, with house and corral furnished.

Mexico offers attractions much superior to the above. Good grazing land can be had for \$500 the league (4,400 acres); and fairly good land can be had at \$270 to \$300. Twelve to eighteen

dollars per league per year will lease the same lands. Titles are good for sales, and lease-contracts are honestly complied with. Herders can be hired at \$9 to \$14 a month, to which must be added \$1.75 to \$2.50 for keep. Ewes can be bought at \$1.80 to \$2 a head. The shearer receives, for the light-fleeced Mexican sheep, one and a half cents a head. The principal drawback is the bad government, and the consequent brigandage.

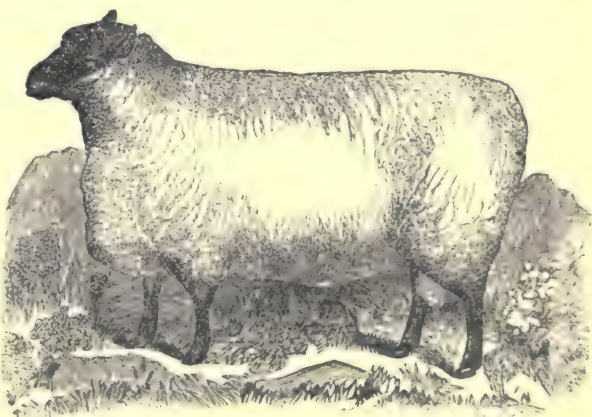
In the selection of breeders there are several points which are quite as important as purity of blood—perhaps more so. Constitution is of pre-eminent importance, and those sheep which have the distinctive race or breed characteristics best developed have, generally speaking, the best constitution. These characteristics should be carefully noted.

The Representative Cotswold is an animal of a majestic port, perhaps to an impartial layman the most beautiful of the various breeds, whose only drawback is the “shortness of space between the hip and flank.” Here is the weak point in the breed—too light in the flank and too leggy; these are faults which should be carefully avoided. There should be a broad, bold breast, a short scrag or neck, of a spirited carriage, and a small, clean, bony head, with bright, prominent eyes, and a conspicuous foretop of wool, often nearly covering the eyes—this being the characteristic point which distinguishes the breed from the Leicester; a broad back and good barrel well sprung out; a broad, heavy tail; hind legs set somewhat under, both they and the fore-legs standing wide apart, erect and strong, with a heavy bone; top and bottom lines straight. There has been some difference of opinion as to the gray or mottled face. It is agreed that it is an index of power and hardiness, and it is now pretty well settled that it should not be held to throw any suspicion of impurity on the blood. Wool, curly, long, and lustrous, not dry and harsh to the feel, but with a slight amount of yolk; skin of a healthy pink. At maturity it ought to be eight inches long, and the fleece averages six or seven pounds. More than that should be obtained from a flock of twenty or thirty. The male should be broad between the eyes.

The Leicester differs from the Cotswold in having a more delicate frame, somewhat smaller and a finer bone; finer and more lustrous wool; a bald head, which is also smaller; white face and legs. The hind-quarters are not so heavy at the tail, and the ham is lighter, though both it and the Cotswold are inferior to the South-Down in this respect.

The South-Down is a fourth or a third smaller than the foregoing, with black or dark face and legs (all three breeds are hornless); low, square, and stocky figure; powerful bone; scrag finely arched; eyes bright and keen, with a general appearance of great liveliness and hardiness.

The farmer seeking to found a flock of Merinos for out-door work, which must "rough it" more or less, at least through the summer, should reject every animal (unless phenomenally valuable in other points) which has wrinkles on the body sufficiently prominent to show on the surface of

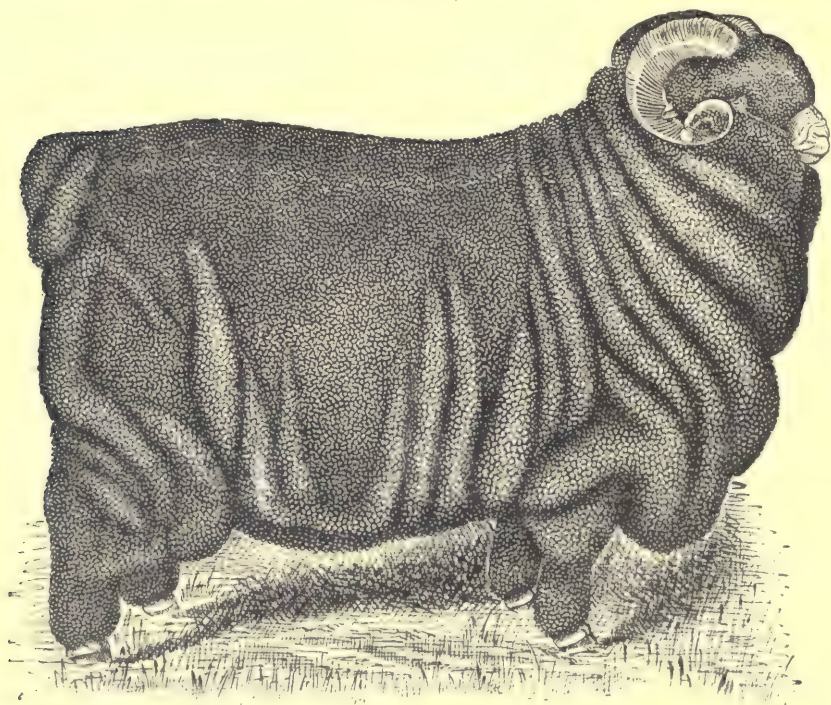


SOUTH-DOWN RAM.

the fleece at maturity. On the other hand, it is desirable to have the skin so generously put on that it shall present that fine spider-webbed or crinkled appearance seen in the well-bred lamb; rich, soft, and loose to the feel; pink or rosy. It should hang in a pendulous fold or web in the flank, giving an appearance of depth; a like fold should extend from the dewlap up the median line of the neck, terminating in a pocket under the chin. The ram may have several heavy folds about the neck, like irregular horse-collars, and the ham may be slashed with two or three wrinkles across the stifle, extending forward and down; but beyond this we should not go. The body should present a plain broadside. The distinguishing crown of beauty

and proof of blood is what may be called the escutcheon—a broad, generous tail, spanning nearly across the rump, the sides neatly folded or tucked under.

It is of the greatest importance to have the body covered all over with a fleece of deep-grown, dense, white or buff wool, nicely crimped or crinkled to the extreme end, not terminating in black points or indurations (which the manufacturer has to clip off with the shears by hand), furnished with a lively semi-



CASH, 101.

One of the Stock Rams in the flock of Merino Sheep owned by Captain J. G. Blue, Cardington, Morrow County, Ohio.

liquid yolk, white, or slightly buff, and not so abundant as to collect in waxy masses along the fiber, or cause the blocks or sections of the fleece to open flatly or greasily. The fleece should be well buttoned up, extending to the coronet of the hoofs; thick, long, and not saffron colored on the belly; completely covering the scrotum; reaching down to the point of the chin, capping the head and extending down in a full-rounded

cape between and below the eyes, but leaving a clean margin around the eyes, and terminating in an even edge, not straggling in patches down the face, which should be covered with white silken hair; hams broad, stout, and low, falling straight from the tail; legs wide apart; capacious barrel; heavy brisket and breast; eyes bright and not hidden by wool; lower jaw wide. The ram, as a mark of vigor, should show powerful spermatic cords, and have the nose deeply fluted or grooved from the corner of the eyes down.

The breeders of the Delaine Merino insist on a white free yolk, a three-inch staple, short, sharp hoofs. The hair which crops out on the thigh of the Cotswold or on the fold of the Merino (called kemp in the former, jar in the latter) is objectionable, and ought to be carefully avoided in breeding animals. It will not take dyes like wool.

Cotswolds and Leicesters, maturing quickly, are less hardy and long-lived than Merinos, though they are held to keep up the wool-producing capacity better with advancing age. They may bear lambs at two, or even at one (this is not desirable), and should cease at five; Merinos may begin at three and cease at seven. Very small flocks or exceptional ewes of either breed may continue in service two or three years longer. Ram lambs may, with caution, serve a dozen ewes; yearlings, five times as many; two-year-olds are capable of full service. Very fastidious breeders restrict a ram to three services a day, with some hours between, and sixty or seventy-five for the season. A very powerful Merino ram has been known to cover three hundred ewes in a season; but it is not advisable to let him go beyond half that number. Only careless breeders, or those on the great plains of the West, allow the ram unrestricted range in the flock.

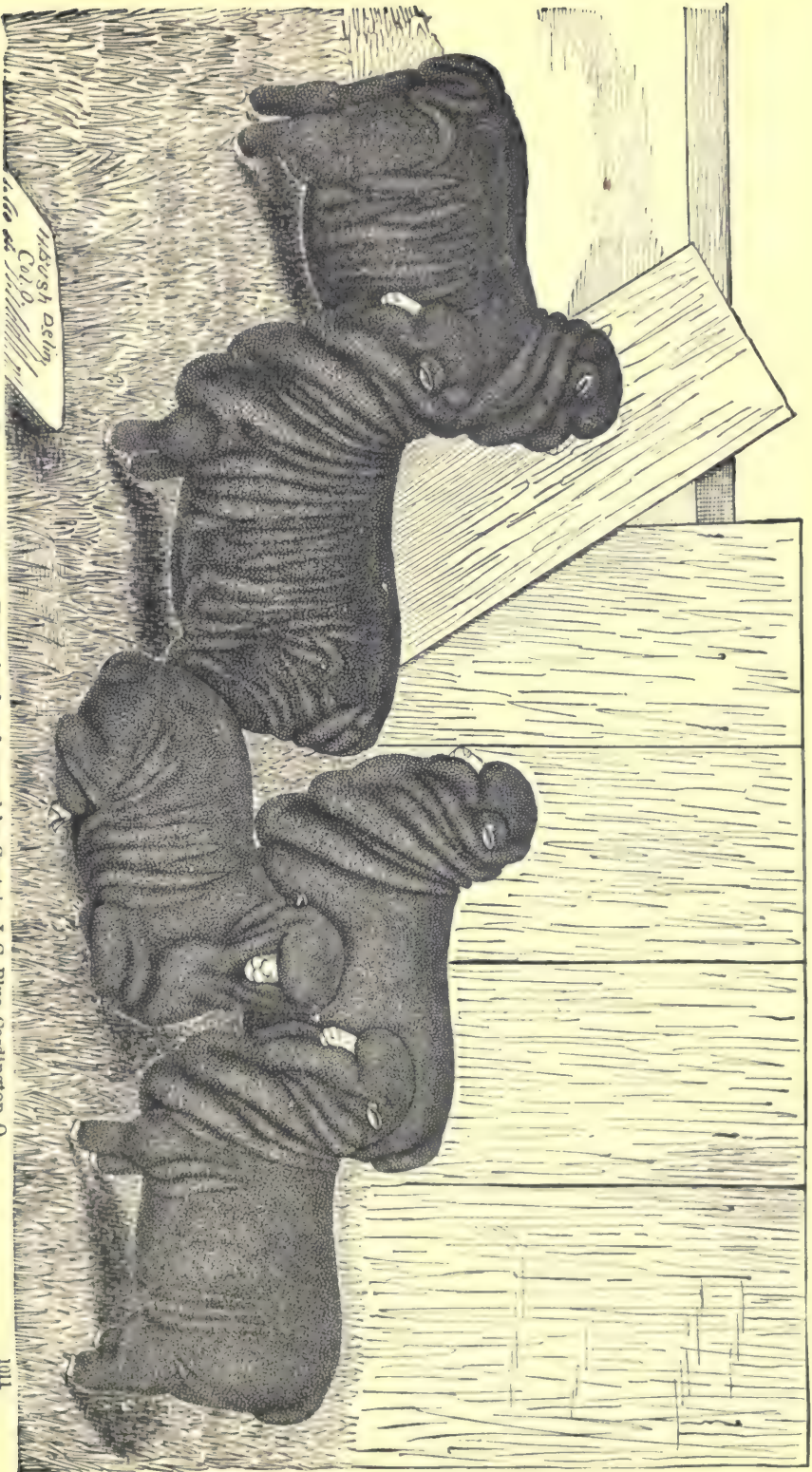
There are several methods of regulating the service, of which the best is as follows: Screw a bolt and ring into the front of the left horn, and tie him up with a leather strap. Bring the flock into the inclosure, and turn the ram loose. When he serves a ewe, catch her with the sheep-hook and remove her to another pen. If the ram resists interference he must be kept tied. The

ewes in season will cluster about him, when they can be caught and penned separate, and the ram admitted at the end of a strap. After about three services, running half an hour, he should be tied up and removed and kept quiet two or three hours. There are other plans which will economize time, but they are not so business-like.

Theoretically, rams should have grain rich in albuminoids, as wheat or oats; but I have found them do as well on shelled corn as any thing—two medium ears per day. With his hay he should have sliced pumpkin or roots or sweet-corn fodder cut up green. Water and salt daily. Through the winter he may be kept tied up with the leather strap in a stall without injury, or the monotony of his imprisonment may be relieved by an occasional promenade in a tight yard. If there are two, and they fight, cut off a section of a boot-leg, slip it on his head, and tie it to the base of his horns. Slit it on the under side, and tie it together loose enough so that he can see down along his nose.

It is advisable to condemn ewes for certain faults in the spring, and indicate it by a durable mark; but most farmers delay the main business of drafting until fall. A "pony sheep" is generally a good breeder. But when one is seen with hind-quarters conspicuously heavier than the fore, choose her; she is of good promise, whether low and stocky or rangy. Marks ought to be affixed to the short-stapled light shearers in the spring. Reject rigorously the leggy, the flat-ribbed, the long-necked, and the sharp-rumped, with the tail set on low. They will produce unhandsome lambs, which will be certain to turn up when the flock is paraded for inspection.

There are principles, or, rather, an intuition, in selecting and breeding which can not be imparted by one person to another except by long communication, and then only more or less superficially. It is a gift of nature. The ordinary breeder can not expect to accomplish more than is attempted by the writer of these lines—to keep a standard, an ideal, and breed straight toward it continually. If only one ram is employed, and he is of a marked prepotency, transmitting his qualities strongly to



A GROUP OF YEARLING MERINO EWES, bred and owned by Captain J. G. Blin, Cardington, O.

his progeny, and those qualities are desirable, he will promote uniformity, and should be retained as long as possible. If two or more are needed they should be worked by a system of checks and balances. Employ each to fortify the points in which the individual ewe is deficient.

In-and-in-breeding, if in a flock of a hundred or more, and regulated by a deep insight and a painstaking record of individuals, is only moderately harmful by reducing the caliber of the bone and impairing the constitution somewhat, and, indeed, the eminent example of Bakewell and Hammond has shown that it is almost necessary to fix and perpetuate certain qualities; but the ordinary breeder had better avoid it altogether.

The question of the relative influence of the male and female in determining certain characteristics, as form, constitution, size, etc., is one which need concern the average flock-master very little. The most eminent authorities are often diametrically opposed. Constitution is of paramount importance in both parents, and unless a sheep is of extraordinary excellence in certain directions, not a single point ought to be sacrificed in constitution if it is destined for a breeder. I have indicated the most important features of good breeding animals in the various kinds of sheep, and in addition I will only say, in reference to Merinos, that there are certain ultra-fashionable points which had better be avoided by the farmer seeking to build up an average wool-bearing flock. Very yolky and wrinkly sheep lack hardiness. In the sudden changes of the American climate the wrinkles become chilled first, their nutrition is impaired, and the wool frequently peels off them, leaving the animal ragged-looking. Besides, the wool on wrinkles is wild and coarse.

Whether lambs should come early or late depends on several conditions—as the breed, the size of the flock, the farmer's situation, etc. The English breeds are presumably not kept in large flocks, and they are good milkers and nurses anyhow; so they may well be bred to drop their lambs in the winter, though even with these I would not advise that lambing should be brought on before the backbone of winter is broken, say February 15th. With Merinos there are also certain circumstances

under which it would be advisable to have lambs begin to come by March 1st. If the flock is small—not exceeding fifty; if the owner is an excellent care-taker, cleans out the sheep-house so often through the winter (say once a month) that the flock keep in perfect health; if he is prepared to feed liberally with clover hay and bran or roots, and willing to spend much time and trouble with recusant ewes, he may with advantage begin lambing early in March. But if the flock is large, and he has no roots, and is a rather careless shepherd, he had better lamb on grass, even if he has to employ a little extra help to carry forward other farm-work. If the coupling season is thrown late, and the pasture is scanty or slushy from excessive rains, the ewes should receive a daily grain ration, say a half-bushel of shelled corn to the hundred. This assists to bring them in season, and to prevent a failure of the service and the necessity of repetition. They ought to be housed in cold rains as early as October 15th.

It is impossible to overestimate the importance of good treatment of the ewes during winter; on this depends in large measure the success of lambing. The number of men who feed too little is comparatively small; a good many feed too much. But the matters in which most flock-masters come short are water, exercise, and clean quarters. It is absolutely necessary that pregnant ewes should have all they want of clean water at least every other day; better every day. Pure cistern water is better than ice water, of course, though the injury resulting from ice water does not amount to much if it is furnished daily. Better ice water with exercise than cistern water without—far better. But the shepherd should never be without a cistern at each sheep-house, for use at convenience. The ewes ought to have at least three hours' exercise every day. A piece of woods or an old tough blue-grass or june-grass sod (they will injure clover or timothy) is best; but an excellent substitute is a corn-stubble, from which all the fodder has been hauled off. A sheep derives a great deal of satisfaction and the all-important exercise in searching for a portion of its feed "in place." It will often quit first-class hay in the rack to roam a field after

third-rate corn-stubble or old rowen, the value of which to the animal is far less than the exertion necessary in collecting it.

Ewes fed generously on bright corn-fodder and fine green-cut hay do not require a grain ration until about the middle of the fourth month of pregnancy. In the early stages of this condition there is a tendency toward plethora and the laying-on of fat, but the shepherd must not allow himself to be deceived by this. Six weeks or so before parturition a grain ration becomes imperative. It need not be large—a half bushel of shelled corn per hundred daily, or its equivalent, is enough. If running with the dry flock hitherto they ought now to do so no longer. Gestation goes on well enough on dry feed (with plenty of exercise), but lactation demands more succulent nourishment. A week or ten days before lambing begins clover, hay, and bran should be supplied, the latter at the rate of a bushel or more per hundred, mixed with thirty pounds of oats or shelled corn. If roots are given, they are better pulped, though ewes will soon learn to eat them whole when thrown into the hay-racks on the orts. It is not safe to give pregnant ewes all they will consume of such cold watery feed as turnips or potatoes; it is liable to produce abortion. After lambing is over there is no danger if the ration is increased gradually.

In the Eastern States it is doubtless profitable to grow roots for sheep in some instances. But in the region west of the Alleghenies, with its abundance of corn-fodder and clover and cheap bran, I doubt if, for wool-growing, it will be found advantageous to provide turnips for winter feeding, at least for many years to come. For the production of very choice, juicy mutton, such as will command a remunerative price only in large cities, roots are important when grass is lacking. Oil-cake meal and cotton-seed cake should be given to pregnant ewes with caution, not over a good handful per head per day.

I wish to make here a strong representation, founded on years of personal experience as to the value of corn-fodder for sheep, especially breeding ewes. It is healthfully cooling and laxative, a corrective of the constipation which is a natural accompaniment of pregnancy. If I were limited to one feed-

stuff I would give them fodder in preference to the best timothy that ever was put into a hay-mow. If I could give only one feed to each I would give the fodder to ewes and the timothy to cattle. Sheep consume fodder almost without waste, even the "thimbles;" cattle leave a third of it. Fodder in the morning, grain at noon, hay in the evening I consider the perfect ration for sheep. It takes some trouble and time—a week or so—to train sheep to eat fodder, but the result is abundantly worth the expenditure.

For ewes in the lambing season the transition from hay to grass is a critical period. If they have not been allowed to range freely on a sod through the winter, the first half-day's grazing on the young and tender grass destroys their appetite for dry feed, and if the grass is not of sufficient body to carry the flock they will fare hardly. Old grass, no matter how abundant, does not impair the appetite for hay. Hence, if they are turned on an old sod or rowen about two weeks before lambing begins, they will continue to relish hay, especially if salt is withheld from them, and brine sprinkled on the hay in the racks. Then, when the grass is well advanced in the other pastures, they may be turned on it and the hay discontinued; but they should receive the bran and grain ration a week or ten days longer.

Where a grain ration is mentioned above and elsewhere it is intended for Merinos, with which the writer happens to be most familiar—for the larger English breeds it should be increased in proportion to their size, say one-half for South-Downs, doubled for Cotswolds, etc.

Pure sheep manure trodden solid in the winter does not throw off ammonia to any hurtful extent, but when mixed with hay or straw it does. The shepherd may not be aware of it when he enters the sheep-house, but the animals are. Their nostrils are down close to it. It is not safe to decide whether the stable needs to be cleaned out or not from simply passing through it. The thoroughgoing shepherd will find a way to bring down his nostrils where the sheep are compelled to carry theirs. There he will very soon discover whether the manure

ought to be removed or not. If the ewes pasture freely on old grass the stable ought to be cleaned out every ten days; if on dry feed, once a month will answer. The penalty for allowing ewes to sleep in an atmosphere foul with ammonia is, a number of still-born lambs in the spring, ewes disowning their lambs because they are sick and have no milk, and, lastly, a quantity of cotted fleeces at shearing-time. When sheep begin to dig their bellies with their hind feet it is a proof that the stable ought to be cleaned out, and that it ought to have been done before.

In default of roots grown specially for them the small refuse potatoes or apples of the farm may be given to breeding ewes with advantage. It is much better to feed out small potatoes than to plant them. An excellent provision of green rye may be had by sowing a bushel of seed per acre in the standing corn—if it is not lodged—about the first of September, just after or before a good rain. If not required for fall and winter pasturage it may be sown after the corn is cut, and plowed in with a shovel-plow. The greatest, perhaps the only, drawback to the use of green rye for pregnant ewes is, that on rich bottom-land the young plant is apt to contain the same fungoid spores which in the mature grain develop into ergot; and this will cause premature delivery and a disowning of the lamb. Hence ewes should not be turned upon it until a week or ten days after yeaning. On uplands green rye is safe.

The necessity of tagging before the flock is turned upon grass is so obvious as to require mere mention to the observant farmer; but many are deterred from tagging pregnant ewes by fear of injury to the unborn lambs. With any decent care in handling this danger is very slight. The ewe may with safety be turned in any position if it is not done with violence. And the importance of tagging is so great, the results arising from a neglect of it are so abominable, that it ought to be done at all hazards. Let the udder be shorn clean, the inside of the hind legs, and a liberal margin along the posterior of the hams, and so around and quite above the tail, for if the wool is as long as it ought to be it will soon fall over after tagging and collect filth. At

shearing-time the space clipped in tagging should not be gone over a second time; it is only a waste.

Lambing.—It is in his preparations for lambing that the consummate art of the shepherd is shown; this is the touchstone of his success. If lambing is not done well no after-spurt of exertion will atone for it, and the profits of the flock will be seriously cut into, if not quite destroyed. The shepherd's motto should be: Eternal vigilance is the price of lambs. Some flock-masters make it a point to visit the sheep-house during the night. Unless the weather is phenomenally severe, or the previous management of the ewes has been unpardonably bad, this is not necessary, even with the comparatively poor nurses, the Merinos, and still less with the English breeds. I take it for granted lambing will be carried on under cover, except during warm, sunny days and balmy nights, when the weather has become settled. The sheep-house used for this purpose should be wholly above ground, thoroughly tight and dry, but furnished with plenty of glass windows, so that it can be ventilated in warm nights or on rainy, muggy days. Newly dropped lambs are prone to crawl into crevices, especially if neglected by the ewes, and get fastened and chilled; hence all these ought to be stopped. There ought to be no stone foundations, or these should be covered with litter, as the lamb is likely to lie on them and get chilled.

At night when the flock is shut in the ewes and lambs already dropped should be removed to a separate inclosure; this prevents a great deal of confusion and trouble. Then at bedtime let the flock-master go carefully through the flock with a lantern, and make matters secure. If the ewes were fed and exercised as they ought to have been during the winter, a lamb yeaned after nine o'clock will get up and do well enough until six next morning without milk. The thermometer may mark ten degrees, and its feet may even be frost-bitten, yet if its mother is healthy and hardy from exercise it will be on its feet and dry in the morning. If it succumbs under this temperature or a higher one, it is a clear case of bad management through the winter, or else it is a lamb of so poor a constitution that it is not worth any thing.

Merino ewes are rather proverbial for stricture of the womb, and for false presentations. A healthy ewe may without injury be left to herself twelve hours from the time she first goes apart from the flock and gives evidence of approaching labor, but it is best to make an examination sooner. A man is not fit for a shepherd if he is squeamish; he must address himself to these disagreeable duties with a sympathetic human interest. If there is stricture, or the womb is grown up, an aperture may sometimes be fretted with the finger-nail; otherwise, a small knife-blade should be pressed close against the forefinger, the point not projecting beyond the end of the finger, which thus guides it in carefully, making a puncture large enough for itself, after which the knife should be used no longer. A false presentation need not necessarily be corrected, and frequently can not be, by a man's large hand. If the head is doubled back, or the side is presented, delivery can not be accomplished. But one or both of the fore-legs may be doubled back and delivery yet take place safely, if assistance is rendered. The English books recommend many different stimulants for a ewe in protracted labor, but none of them is to be compared with a little mechanical assistance, judiciously rendered. After a ewe has been two hours in actual labor-pains she ought to be relieved; it is cruelty to leave her longer. If the pulling is distributed evenly between the two legs and the head it may amount to fifteen or twenty pounds without injury.

As soon as the lamb has drawn a few breaths the umbilical cord is severed, and the lamb is laid directly at the ewe's nose. If she falls to licking it, all is well. If the pain of a tedious parturition has rendered her insensible to the claims of natural affection, she will have to be confined with it in a very small pen. There, if she has a good supply of milk, she will probably own it in a few hours; but if she is destitute of milk there will be trouble. A Merino ewe had better have her first lamb on grass. There is nothing else on earth equal to it for making a flow of milk, and the consequent flow of natural affection.

If it is possible to save the lamb's life without carrying it into the house it ought to be done; the ewe is apt to disown it

if it is removed and the scent on it (by which she recognizes it) confused. On the other hand, she will own any thing, if, while still lying on her side, before she has seen or smelled her own lamb, the stranger is well rubbed in the *liquor amnii* and laid before her. If it is chilled and unable to suck, bring out hot flannels and put around it, leaving the head out for the ewe; give it a tea-spoonful or two of warm (ewe's) milk. Give no cow's milk for the first three or four feeds, if it is possible to avoid it. After the lamb has once sucked its fill there will be no further danger. Still, all this pudgering only makes accusation against a man's mismanagement through winter. Even full-blood Merinos, seven or eight years old, if well exercised (this ought to be *burned in*), will rear their lambs under the above-mentioned temperature with very little assistance.

Nothing ought to be taken for granted as to the establishment of working relations between ewe and lamb until the latter is actually seen to suck. When for any reason it is unable to do so, but is lively, the ewe should be laid on her left side, the lamb on its right, the jaws opened with the left hand, and the teat inserted. It will soon get a taste and begin to draw. A ewe lambing on a full feed of grass sometimes gives an excess of milk, and the lamb will neglect one teat. It will become swollen and ruined unless relieved. The milk ought to be drawn from it, and the ewe confined to dry feed three or four days.

Ewes restricted to timothy hay and corn, even when most liberally fed, sometimes lose their lambs when ten days or more old. They die of constipation, and the remedy is more relaxing feed for the dams, with a teaspoonful of magnesia and two table-spoonfuls of black molasses to the lamb. On the other hand, breeding flocks running on flat, sour lands frequently suffer heavy losses in lambs, generally the fattest and largest. The head is thrown back, there is tremor and convulsions, some froth at the mouth. The disease is popularly called "lamb cholera." In most cases it is probably only a severe case of colic, the preventive for which is a liberal admixture of lime or wood ashes in the dams' salt, which should be kept constantly in a covered trough.

Lambs are best castrated when very young; as soon, in fact, as they are owned by the ewes beyond question. They suffer less then. The best way is to seize the pouch in the left hand, work the testicles well down, draw it across the top of a hay-rack, and with a single stroke of a sharp knife cut it off smooth with the belly. This leaves no cod to interfere with shearing. The sooner the tails are cut off the better, too. An assistant holds the lamb's back to his breast, head uppermost, a hind leg grasped in each hand and drawn well up. The knife is applied at a joint—a bone cuts hard—and a vigorous cut made downward and outward, which leaves a hood or apron to protect and cicatrize the disjointed bone. An application of fish oil prevents the attacks of flies, and is less objectionable than tar. If the whole flock is docked and castrated at once it is best done in the evening, in cold weather; then in the morning the lambs are ready to follow the flock, and no measures have to be taken against flies.

Lambs should not run with the flock much, if any, beyond four months. This gives the ewe only three months rest in the year. When weaned it is well to let them remain in the same field and remove the ewes to another one out of sight and hearing. I have never known Merino ewes to be injured by the sudden cessation of the flow of milk. In the case of the English breeds it is well to relieve the freest milkers by hand in twenty-four or thirty-six hours after the lambs are removed.

On the short, sweet grass of uplands lambs kept for wool mainly will do fairly well without grain until frost comes; but they should not be stinted for water. Careful watching is needful to forestall the maggots. It is best to tag the ewe lambs at weaning. A good shade should be furnished. If an open shed on rising ground is accessible they soon learn to prefer it to trees, and the gad-fly is not so liable to attack them here. If salt is given them in a trough while with the ewes they will learn to approach it more readily for grain. When rations of this are first given salt should be withheld, except a very little sprinkled along the bran. In a few days they will take it without salt.

If lambs are from young ewes or are behindhand for any other reason the bran ration should be given at weaning and slowly increased until they have all they will eat twice a day, else there is great danger that the weaker ones will not survive the winter. A weak lamb in the fall is a wretchedly poor piece of property. By the first of October they should be housed at night and not let out until the frost is off in the morning. A sprinkle of very green, fine hay should be strewn along the boxes, and they will soon learn to eat it up clean before they go afield.

The care of lambs in winter is a matter of the first importance, and should be managed by the owner himself. A little oats ought to be added to the bran as the grass gets shorter, and presently corn. By Christmas one hundred Merino lambs need daily a half bushel of feed composed of equal parts of bran, oats, and corn. The three feed-stuffs are here mentioned in the order of their preference; but, in default of the first two, I have wintered lambs very well on shelled corn, three or four gallons a day, to one hundred, varying a little according to the weather. Grain is best given twice a day, but should not be offered (to lambs) the first thing in the morning. They are more sluggish at rising than older sheep, and several—the neediest ones—would lose most of their ration if given in the morning. It is very poor economy to crowd them at the troughs; let these be ample in number, flat-bottomed by all means, and ranged around the side of the yard to keep the lambs from jumping into and fouling them.

Pure water at least every other day, three or four hours' exercise every day, and constant access to salt will not be denied by the wise flock-master. The shed is best left open on one or two sides, except in heavy storms.

As with ewes, the operation of letting down the flock from hay to grass needs judicious management. The greenest, finest hay should be reserved for the capricious appetite of spring. The best resource is an old stiff sod of such small compass that they will keep it depastured close until it is time to turn wholly on grass. At all seasons of the year when flocks are housed at

all I favor housing or feeding in the forenoon until they eat their dry feed. This is the flesh-maker and tonic, the food and the medicine, and must be taken. Grass is yet only the apple after dinner.

Fattening.—Perhaps I may as well speak here of the subject of feeding sheep (wethers) for the shambles. It is a matter of difficulty and often a discouragement to the beginner, because the dainty sheep, especially the Merino, will not lend himself to the fattening process like the omnivorous hog. No Merino under three and a half years should be selected for winter feeding; from that age upward, as long as they have sound teeth. It is a waste of time and feed to attempt to do any thing with an animal not in fair condition in the fall. Nearly every body feeds for the early spring market, intending to retain the fleeces; hence the best results can often be secured by selling in the wool in midwinter. This is especially the case where the feeder has facilities for grazing until January or February. They should be put on a daily feed of shelled corn—sown broad-cast on a clean, short sod—early enough in autumn to prevent any falling off in condition from frosted grass, and housed at night. If more convenient, feed in troughs. One hundred large wethers require a house, say thirty by thirty-five feet, with a yard attached. When sheep are heavily fed on grain I prefer good corn fodder at least once a day to a steady regimen of hay. Oat straw or wheat straw cut when the kernel is in the doughy state is a good coarse feed for heavily grained sheep. Clear timothy is too binding; clover is preferable. A good grain ration may be made by combining shelled corn one-half, chopped rye, shipstuff or oil-cake meal one quarter, shelled oats one quarter, giving all they will eat clean twice a day. It is careless feeding even with hogs to leave grain lying by them, and still more with sheep. Sheep highly fed have capricious appetites, varying with the weather. The flock-master should watch them at every feed. If there is a considerable remnant of corn left in the troughs and a few linger to clean it up, they ought to be driven out of the pen and the feed removed, else at the next feeding-time one or more will be “off.” Water and salt freely,

keeping in the salt about $\frac{1}{3}$ of fine copperas and a sprinkle of sulphur. If sheep are fed exclusively on corn a little sharp wood ashes in the salt is good to keep their stomachs sweet; they are liable to vomit up the corn. Plenty of bedding is requisite, else the dung will accumulate between the hoofs and cause scald-foot, which has a tendency to pull the animal down. After they are once put on heavy rations of grain the fattening process ought to be closed up in five or six weeks at the outside. A longer period diminishes the profits. Some will probably have to be drafted out anyhow and reserved for fattening on grass.

In selling unshorn mutton-sheep the farmer is liable to be overreached unless he keeps distinctly in view the two elements, the carcass and the fleece. Do not "lump" them. Weigh the sheep for its carcass, and estimate the fleece by the average of the flock in previous years, and the number of months' growth, adding a pound on account of the greater amount of yolk secreted by fattening sheep.

When wool is the object sought in feeding, corn-fodder and oats will produce more of it than timothy and corn, value for value. A given sum of money invested in good wheat straw and corn will produce more wool than the same amount expended for timothy—at least west of the Alleghenies. With three hundred pounds of straw feed one hundred and twenty pounds of corn (this to one hundred and fifty Merinos). A flock fed this way, and given an appetizer twice or three times a week by a run on an old sod, will winter satisfactorily to the middle of March; then they should have hay for a month, with a half-bushel less of corn.

Sheep should never be allowed to run at will to a straw-stack; they get chaff in their fleeces, besides wasting a vast amount of material too valuable for mere bedding. At threshing-time, if the farmer can make such arrangements that the chaff will be well disseminated throughout the stack, it is well to dispose of it this way. Otherwise store the chaff by itself, in a rail pen, if no better method offers, very thoroughly roofed with straw. Have the roof so supported that the chaff can be

excavated and carried away underneath during the winter. Have a basketmaker make a basket of two or three bushels' capacity, in which to carry out the chaff to the hay-boxes. Give straw in the morning, chaff in the evening. If the straw is stacked as it ought to be, with a smooth and even surface, it will keep well; a slice at a time can be cut down with an upright hay-cutter, pitched down with a common fork, and carried out on a straw-fork. This can be made by any blacksmith in the following manner: Take a bar of steel five feet four inches long, three-quarters of an inch wide, and one-half inch thick; split it down at the ends far enough so that the tines (four) shall be two feet long, and have an entire spread of twenty-one inches. Weld on a shank, and insert it into a handle.

The flock-master must bear in mind that there is a wide and important difference between the stud-flock and wool-flock. When he hears or reads that a certain celebrated ram produces a fleece of twenty-five, thirty, or thirty-three pounds, he must remember that every pound of that fleece may have cost the owner from twenty-five to fifty cents in extra keep and care. In other words, the animal is not kept for wool as a primary object, and the statement of the weight of his fleece is very liable to be misleading.

Just here present themselves considerations of housing and other ultra artificialities of breeding. If men choose to house their sheep as they would callow turkeys, touch up the frayed places in their fleeces with lampblack, supply a little oil judiciously, "stubble" their caps and their legs to promote the growth of wool on those parts, etc., in order to compete against each other at a fair, they have a perfect right to do so. But to offer these pampered animals to the average farmer as a foundation for an outdoor, wool-bearing flock, destined to climb rugged hillsides for a living, is scarcely legitimate. The fashionable, dark-surfaced (almost black) fleece, opening up deep with the rich, dull luster of "old gold" or buff, oily as a hickory-nut, and a mellow pink skin folded in ample corrugations—the very presentment of fat double-chinned opulence—these are very captivating to the eyes of most novices. But the eye should

be trained to penetrate beneath these disguises. It is an error to suppose that a buff-colored staple is necessary in the ram as an indication of vigor. The greatest hardiness is oftener associated with white wool. It is more important to seek an animal possessing heat and vitality enough to keep the yolk semi-liquid, glistening, and well-diffused along the fiber. Next after constitution it is important, above all, to have a good-stapled, deep-grown fleece, well crimped to the very end and free from black-tops.

It is also erroneous to suppose that a small amount of native blood ought to be retained in the veins as a conservator of hardiness and of the milking and nursing aptitudes in the Merino. As between an average full blood and a grade treated alike, and from ancestors also treated alike, the full-blood is the better every way. It not only reproduces itself with more certainty, but also bears wool more nearly equal in length wherever any grows at all, of a greater number of fibers to the square inch. Nor does it fall behind in constitutional force as mutton or as a nurse. The full-blood has become the object of wrong notions and prejudice simply from the false and pampering methods to which it has been subjected.

As between systematic exposure to all kinds of weather, winter and summer, and too close housing in an atmosphere vitiated by animal exhalations and ammonia escaping from the manure, the former is unquestionably to be preferred, even for breeding ewes. But this is no argument against judicious yarding and housing. The retention of the yolk in the fleece is the least worthy of the motives presented for this practice. The swift, drenching rains of the fickle American climate, quickly followed by biting cold winds, furnish the true reason for housing. The very argument which many present for leaving the flocks exposed to the storms—that they are protected by thick fleeces which prevent the water from reaching the skin for a long time—makes in favor of housing, because animals covered only with hair dry off sooner than sheep. An average fleece will absorb and carry from seven to ten pounds of water; and the sudden conversion of a considerable portion of this into ice in

close proximity to the body subjects the animal to much unnecessary suffering. It will endure, with impunity, a high degree of dry cold; but, above all things, sheep ought to be kept out of water, both that from above and that on the ground, at least in the winter. Let the advocate of open-air management, who argues volubly on the sheep's abundant "natural covering," conceive of himself exposed to the long rains of winter, protected with a coating of sponge instead of water-proof oil-cloth, and he will have the subject before him in a personal and comprehensive shape.

Washing.—This leads naturally to the subject of washing. It would undoubtedly be better for all concerned—manufacturer, farmer, and the sheep itself—if the practice was wholly abolished; but it is useless to make outcry against it so long as the farmers are firmly grounded in the belief that the rule requiring a deduction of one-third on unwashed fleeces operates unequally and in a majority of cases unjustly. Washing is an operation which may be performed so thoroughly or so slightly that it has been the source of endless humbug and swindling. But the mere color of the wool deceives no expert. The great remedy for all the evils which have barnacled over the whole business of wool-growing and wool-selling lies in the closer approximation of the manufacturer and the farmer, which will come only with the cessation of the "lumping" methods of a comparatively new society and the introduction of closer specialization. When every man's clip is thoroughly inspected by an expert buyer, and a just system of deduction enforced in each individual case—for there must always be a current market price—when that time arrives, the farmer can act his pleasure as to washing. Until that time comes the interest of his pocket will leave him little option.

Washing is best done in a small stream of soft water, dammed or conducted into a vat, and the earlier it can be done in the season without discomfort to the men the better. There are often hot days late in April or early in May when the water in a brook is warm enough after nine o'clock to cause no serious inconvenience to man or beast. A pond large enough to accom-

moderate four men will cleanse five hundred sheep by four o'clock, giving them time to drip sufficiently not to suffer during the night. A rising barometer should be selected, with a fair prospect of at least one sunny day succeeding the washing. As in hay-making, it is best to enter on this work soon after a storm rather than just before one. If the men are not all equally good workmen, let the sheep be passed along the line, the best man handling them last; and let him stand up-stream, so that the rinsing may be finished in clean water. Freshly washed sheep, especially the open-fleeced English breeds, ought to be protected from cold, drying winds as much as if they were shorn.

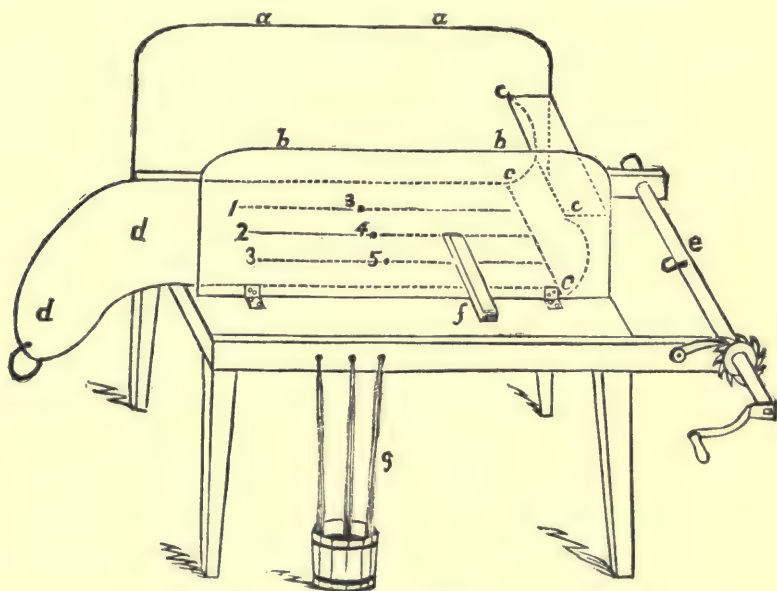
If the water is cold and the yolk half thickened, tending to waxy lumps, only a little, if any, will be removed. This is washing only in name. Yolk will reform in the fleece as rapidly on cool days as on warm ones, but it is not so apparent. The farmer can let his flock run after washing as long as he chooses, but if a long time is allowed to elapse—say over two weeks—certain fleeces will resume the strong sheepy odor and the abundant yolk which they had before washing, and which will probably cause them to be “docked.”

The Art of Shearing can not be taught on paper. But the master should insist on the shearers attending to certain points. The fleece ought to be opened up the neck and not on the shoulder, for both shoulders should be kept intact, as the best wool comes from this quarter. The belly-piece ought also to be left hanging wholly on one side or the other, not divided down the middle. The fleece should never be cut twice, and it is not worth while to go a second time over the surface tagged early in the spring.

When the fleece has been spread out on the table, outside uppermost, and gathered into its natural position, backbone straight, the first thing is to examine the breech and remove the dung-balls. Now fold the breech over about six inches, then the flank, then the neck, and last the belly-piece; this leaves the latter where it is convenient for the sorter to find and detach it. The fleece now lies on the table nearly square. The folder then lays his right arm across the middle, and by a

quick skillful motion of the left doubles this square upon itself with a clean fold (not rolling it up), when it is ready to be placed in the press.

The press figured herewith is for average Merino fleeces; for very large ones or for Cotswold fleeces the box would need to be somewhat wider. The table is two feet six inches high, two feet two inches wide, and four feet long. The leaves are four



WOOL-PRESS.

a a, upright leaf; *b b*, drop-leaf; *c c c*, head-piece; *d d*, leather band; *e*, roller; *f*, support for drop-leaf; *g*, the twine; 1, 2, 3, the slits in the strap for strings.

feet long and one foot wide. The box inclosed between the leaves is eleven inches wide. The head-piece, *c c*, is six and one-half inches high. The side-pieces of the table project far enough beyond the end to support the roller, *e*, which is three inches in diameter at the thickest part, tapering slightly toward the ends. The drop-leaf, *b b*, is hinged, and falls forward toward the operator. When the fleece is placed in position the drop-leaf is raised, the leather band, *d d* (six feet long and eleven inches wide), is carried forward and wound up on the roller. The fleece should not be drawn down too tight, as it makes it hard and soggy. The strings, three in number, should be light, and they

ought to be cut close to the knot, so as not to give the owner an appearance of seeking to sell twine for wool.

All fribs from the shearing-table, spring-cut tags, and pulled wool, whether washed or not, ought to be kept by themselves, not put into the fleeces.

Sheep dying through the winter should be skinned at once; the pelts may be sold, washed or unwashed, or the wool may be loosened with lime-water and sold as pulled—whichever is found most profitable.

If unwashed, sheep should be shorn from the 20th of April to the 15th of May, according to the latitude and weather; if washed, from the 20th of May to the middle of June. It is a well established fact that flocks do better when shorn in April, if reasonable provision is made for housing in storms for a week or ten days afterward. This is especially true of suckling ewes. The heat retained in their bodies by heavy, burdensome fleeces, worn late in May or June, tends to dry up the milk and enervate the system. They can withstand the loss of the fleece comparatively better in cool weather than they can after becoming enfeebled by it in the summer heat. If well-bred flocks are sheltered from all storms, from November 1st through the winter and spring, shorn before they are turned to grass—say from April 10th to 20th—then protected a week or two, their wool will not only be as white generally as it is after washing at the usual season, but it will generally weigh enough to enable the farmer to submit without loss to the one-third deduction. If it should perchance bring him a few cents less per head, the sheep will do enough better to counterbalance the loss, if not more. Thrifty tegs shorn as early as April 15th will frequently gain ten or fifteen pounds before June 1st—worth more than a pound of wool. Cotswolds will frequently gain twenty or twenty-five pounds.

The flocks ought to be carefully drafted and marked or labeled at shearing-time. Marking should be done with red lead, Venetian red, or some paint which can be scoured off; tar is very objectionable. Drafting ought to be instituted as soon as the sheep reaches the age of one year, for it has then demon-

strated its relative capacity for the production of wool and mutton. It is important to conduct the draft on correct principles. Many farmers argue that they will bring the weight of the fleece up to a desired standard, and afterward breed for a long fiber; but this puts the cart before the horse. The production of a good stapled, deep grown fleece (in the Merinos), is of the first importance. Let the matter of weight absolutely take care of itself. The more wool, the more weight. Yolk is utterly valueless in the fleece except as a softener and preserver of the fiber, and a sheep that is thoroughly healthy, vigorous, and properly cared for, will produce all of it which is requisite. To cultivate it beyond that is a clear fraud, which, in the long run, will not prosper. That "density" which is so admired by many is in a majority of cases a delusion, because it is only yolk. It is customary to say that a long staple can be secured only at the expense of density, but this is erroneous. Sheep of equally pure blood have differing aptitudes. One will have an abnormal tendency toward the secretion of yolk, which takes place at the expense of the fiber, rendering it short and comparatively weak. The other—almost invariably the hardier of the two—secretes less yolk and more, that is, longer, fiber. An eminent expert once said to the writer, he did not care how much yolk there was in wool, if the latter was white; meaning thereby that if the minute cylinder of yolk which invests each fiber like a sheath remained so thin as not to conceal the color of the staple it was not possible for it to be in excess.

Hence, in the draft those animals ought to be marked for withdrawal and sale which are, first, deficient in constitution; second, gummy and short fibered. It is generally the heavy, yolky woolled ones which die, while those of voluminous, white, elastic fleeces, which make a great armful, possess an abounding vitality. The rejection of a sheep merely upon its failure to produce a fleece of a given weight, is highly inartistic; it is to work by a coarse "rule of thumb." A good sheep to keep should have a long fiber and a short leg; be low and stout, with legs wide apart, etc. (See foregoing description of good breeders.)

Ticks.—The presence of ticks in a flock of Merinos is a serious imputation upon the keeper's thrift; but less so with the open-wooled English breeds. Now is the time above all others in the year to give them the slip. After shearing they will disappear from the shorn sheep, some taking refuge on the lambs, and the latter must be dipped in a vat of strong tobacco water (made by boiling ten to fifteen pounds of stems in water, to which enough cold water is added to dip one hundred lambs), with an inclined leaf to carry back the drippings into the vat. Or arsenic water may be used, if cheaper—three pounds of white arsenic, dissolved in boiling water, and then diluted with forty gallons of cold. The lamb is immersed back downward, care being taken not to let the liquid enter the eyes and nose. If yearlings are infested with ticks, they may be held in check so as not to injure the sheep until shearing-time comes by giving them free access to salt mixed with one-third part of sulphur, and housing them from the storms. A flock well dipped and cared for afterward ought never to have ticks on them again.

Maggots are one of the greatest pests of summer, especially on the evil-smelling Merino. Rams at shearing should receive a light smear of tar around the base of the horns, and on any contusions which they may make by fighting. Ewes, if wrinkly, and with a tendency to foul, should be carefully watched, kept dressed with the shears and fresh, soft tar applied. Early lambs have wool of considerable length at weaning time; ewe lambs should then be tagged a little about the posteriors, and the wether lambs at the pizzle, and those parts touched with tar. Nothing else will supply fully the place of tar, but it must not be daubed on thick, else it will smutch the fleece. When maggots once get a foothold, only the greatest thoroughness will dislodge them. Shear close to the hide, rigorously hunt them out with a sharp stick, then smear tar solid over the whole space covered by them. Turpentine or kerosene will expel them more quickly, but these are hard on the sheep, and it is better to spend more time in digging them out. It may be necessary to sprinkle the adjacent wool with them to prevent the flies from laying more eggs, and to keep the sheep in the dark.

Water is absolutely essential to sheep in winter, but dry flocks will do very well without it in summer if the nights are cool and dewy and the grass succulent. Otherwise it is cruel to withhold it from them, and I have known healthy sheep to die from pure thirst during a long dry spell in summer, though pasture was abundant. Nursing ewes ought to have daily access to water at all times of the year.

Frequent change of pasture is conducive to thrift, even if one flock follows directly after another. A large flock kept in a small field a few days is better than a small flock kept in it continuously.

It is difficult to feed sheep too well in winter, but the practice of feeding in summer, except in the case of lambs after weaning, can scarcely escape the opprobrious designation of "pampering." This is legitimate with sheep intended merely for display; but a sheep which is expected to be of any use to the practical farmer as a breeder ought to be capable of gaining a good living in summer on pasture alone. The same objection does not lie fully against summer housing, for a sheep long accustomed to it—if not pampered and ruined by excessive feeding at the same time—may easily be weaned from it without injury. Still, summer housing can hardly be said to be a subject having any practical interest for the average farmer.

Salt, of course, should be given in abundance; it is best to allow constant access to it in covered troughs. There are various ingenious devices for causing the sheep to smear their noses with tar in the act of licking salt, as a means of preventing the attacks of the gad-fly. I do not attach much importance to them, mainly because the vast majority of farmers would be apt to neglect them. Free access to inclosed buildings, and plenty of dust to stamp and snuff in, are of more practical value in warding off the fly.

Fly.—When the fly has succeeded in its attack, and the consequent grub is developed in the head, it is difficult to dislodge it. The most practicable method is to syringe out the nostrils with a bulb syringe having a nozzle six inches long. Let this be worked up carefully—it will go up nearly if not quite

its length; then by a quick pressure let a half-teaspoonful of turpentine be spurted into the nasal sinuses, and the nozzle at once withdrawn. After a hot, dry season, when the fly has been troublesome, it is well to treat the whole flock of lambs this way in the fall, as a preventive.

Paper-skin.—Probably the most destructive pest of the sheepfamily east of the Mississippi is the paper-skin, a popular term for the anæmic condition produced by various visceral parasites. It is our province to discuss here only preventives and remedies. It attacks principally young sheep, generally during the first year of their lives. Its indications are: a waxen-white pallor of the skin, lassitude, thirst, frequently a deep but noiseless cough following exertion, great loss of weight not attended with a corresponding emaciation, loss of power, “dumpishness.”

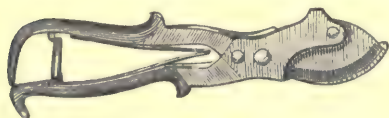
A wide range of experience by practical shepherds has shown that the best preventive is finely powdered copperas, kept constantly in the salt until the sheep has passed the month of May or June the second time, *and high feeding*. Some excellent flockmasters use only one-twentieth or one-twenty-fifth part in the salt, but they supplement it by very generous feeding, *which is of the highest importance*. In a very wet season, when the parasites are worst, it may with advantage be mixed in the salt at the rate of one-tenth or even one-fifth. Let it be distinctly understood that copperas is here recommended, not as a remedy after the parasites have obtained a foothold, but as a means of forestalling them; and that, in order to secure good results from it, it must be kept in the salt unremittingly for the length of time above indicated.

It is a very discouraging task to attempt to medicate a lot of lambs in which the parasites have become firmly seated. Probably there is nothing better than turpentine in this case, though in the hands of a careless operator this is apt to work fatal results. Let it be mixed, half and half, with whisky or linseed-oil, and kept well shaken up while in use. Let the operator put a dose—generally about a tea-spoonful—into a small vial with a long, slender neck, stand astride the lamb

(which maintains a natural position on its legs), open the jaws, pass the mouth of the vial down below the root of the tongue, empty the dose, and hold the jaws open, working the throat with the thumb and finger outside until it swallows. Free access to water is required.

Scald-foot, or Fouls, is a slight galling or maceration in the cleft of the hoof, generally produced by wet grass or dung, and unless long-continued—it usually cures itself—it works the animal very little if any injury. But on account of the popular ignorance and prejudice, which associate all lameness with the dreaded foot-rot, and also on account of the maceration and fetor which result from the scald affording an attractive asylum for the parasite which is supposed to generate the true foot-rot, it is best to medicate the scald. On some soils it will never terminate in the rot; on others, there seems to be conclusive evidence that it will. The simple scald is not infectious; it will remain for weeks confined to a single member of the flock; it never passes beyond the cleft, though, if neglected, maggots sometimes get in and work grievous damage, if not total ruin, to the feet. But the foot-rot spreads through the flock, speedily seizes upon the heel as being the softest and most accessible portion, from this invests the whole foot within the horny covering of the hoof, and reduces all the fleshy part and the gristle to a mass of putridity and rottenness.

The thick, soft, club-like feet of the American Merino are more subject to the greater as well as the minor malady than those of any other breed. What will prevent the scald will



TOE-SHEARS.

assist largely in preventing the foot-rot. The toe-shears ought to be used at least twice a year. The thick, semi-unquilate masses on the inside of the hoofs ought

to be kept pared away with a stout knife—a hooked pruning-knife is a good implement. If a little blood is drawn it will do no harm; it is best to err on the side of thoroughness. Some club-footed sheep demand the knife every month. Unless especially valuable otherwise, they ought to go to the shambles.

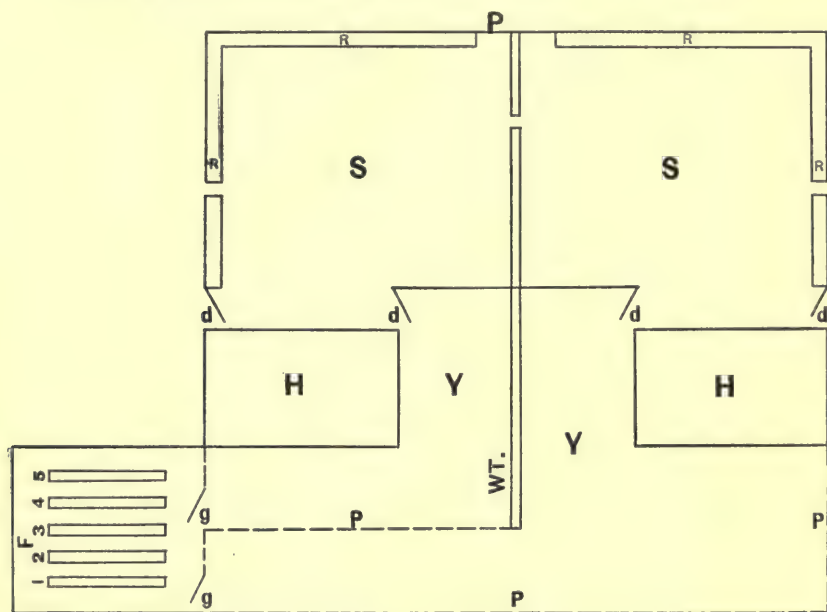
If the scald is present, a little finely powdered blue-vitriol sprinkled in the cleft is sufficient. If the foot-rot appears the affected animals ought to be isolated at once, their feet cleansed and thoroughly pared with the knife until the disease is laid bare in all its lurking-places; then the animals ought to be made stand in a foot-bath of blue-vitriol (water with all the vitriol it will dissolve) ten or fifteen minutes. They should be kept twenty-four hours where neither moisture nor dung will get into the cleft to impede the action of the vitriol. A repetition in a week or two may be necessary to cure up every case.

Scab and its treatment were mentioned in connection with the Territories. It is supremely true of the sheep that an ounce of prevention is worth a pound of cure. After years of experience I have practically discarded all remedies except copperas as a preventive of paper-skin, and vitriol for foot-rot. Good feeding, good care, exercise, water, salt—these are worth to the shepherd more than all the medicine-chests in Christendom.

Sheep Barns.—A flock of one hundred and fifty Merino ewes or one hundred Cotswold ought to have a sheep-house forty-five by forty feet, or its equivalent. For a dry flock of Merinos a shed seventy-five by sixteen feet will suffice for two hundred and fifty head, if no hay-racks are set in it. If they are, additional space will be required equal to that occupied by the racks. For this shed no sills need be used. The timbers required will be two plates, say five by six inches; two posts five by five inches every ten feet; a rafter two by three inches every twenty inches; a girt four by four inches every ten feet. If oak is convenient the roof may be made of this material—home-made shingles, twenty inches long, six inches laid to the weather. For each post dig a hole two feet deep, and fill up with broken stone well hammered down; on this lay a flat stone. Have the siding come down within six inches of the ground. Dig a little trench, and set up thin flat stones on edge, the tops resting against the lower end of the siding on the inside. Fill up the shed so deep with earth that it will never be flooded. The earth will touch the stones, and will not rot the siding. The shed need be only high enough to allow a team to pass under

the girts to haul out the manure. The building should be long north and south, as affording more protection to the yard from storms. The east side can be left open, if desired. The manure may be thrown out through large doors on the back side; but it is better to arrange to drive through lengthways with a team.

A good form for a sheep-house, designed also for the storing of hay, is, a main building sixteen or twenty feet wide, as long



GROUND PLAN OF SHEEP HOUSES AND YARDS.

S S. stables; H H. Haymows; Y Y. Open yards, protected on outside by a picket fence, P P P. made dog proof; W T. Water trough; d d d. Doors; g g. Gates; F. Feeding yard; 1, 2, 3, 4, 5, Feed-troughs.

and high as desired, with a wing or shed on each side twelve feet wide. After the hay is settled a hole can be cut with a cutter through which the hay can be dumped down into a central rack into a dumping-pen, from which to be distributed; or it may be thrown down at the sides into the wings, falling into racks placed along underneath. Swing-doors are objectionable in a sheep-house; hoisting-doors or sliding-doors are better, especially when it is necessary to give speedy exit to a large flock.

All grain-troughs or water-troughs inside the house are faulty, unless constructed to swing down on hinges; otherwise they col-

lect dung. It is better every way to have both out-doors. The grain-yard ought to be a separate inclosure from the fodder-yard, with a separate door leading into it. One grain-yard will answer for two or more flocks if the sheep-houses are grouped near together, or the one building is partitioned off inside with hay-racks. In the grain-yard place the troughs around the sides, or set them in rows (with a light slat-fence just above each to prevent the sheep from jumping over them). Then the grain can be distributed evenly in the troughs at leisure, the sheep let out, the door closed, and while they are eating, the hay or fodder can be scattered in the racks in the stable, or the yard also at leisure.

There are many ingenious contrivances for allowing the sheep to eat the chaff and fine hay from the bottom of the mangers, and for preventing them from thrusting their necks full length into the hay and getting chaff into the wool. I attach little importance to any of them. In the first place, the orts ought to be removed every few days and given to horses or cattle, or placed in a separate manger for the sheep, and brined. In the second place, unless sheep are shorn while still on dry feed, what little chaff lodges in the neck-wool from the old-fashioned manger will be worked out before shearing-time by the action of that felting property of the fibers which is designed by nature to expel dirt from the fleece. In the third place, if the feed is good, sheep will not waste any to speak of in an ordinary slatted manger. To make a good manger, cut hay green.

A manger for lambs ought to be two feet wide (for grown sheep, thirty inches); any length that is convenient, say twelve feet; at least three feet high (if used out-doors), to keep leggy sheep from jumping into it, and to serve as partitions if needed. Let the bottom boards (end and side) be a foot wide; the top, six or eight inches; the four posts, three feet long, three by three inches. Let the slats be of light stuff, three inches wide, nailed on so as to allow fourteen inches for a large sheep or a ewe for standing-room, nine inches for a lamb—one slat between each two sheep. Round off all edges to prevent fretting of the wool.

Sheep-hooks.—The shepherd's crook or sheep-hook is a tool not used by one flock-master in five hundred, yet it is a wonderful labor-saver, especially in lambing-time, when every ewe has to be caught once and often several times. The shepherd can save himself many a hard chase and lame back by the use of one, and any blacksmith with a modicum of ingenuity can make it. Take a three-eighths or one-half inch bar of spring steel, weld it on to the socket of an old hoe-handle, and give it the shape herewith figured, with dimensions as follows: Socket and crook together, thirteen inches long; the recurved lines four inches in a straight line, or about five and one-half inches in its windings; the bulge one inch across on the inside; the neck,



SHEEP-HOOK.

seven-eighths inch. The shank is left round, the crook is flattened a little. The handle of wood is about six feet long. In using it catch the sheep by the hind-leg just above the hock-

joint, and pull back and up with a quick jerk, so as to lift the animal partly or nearly off its hind-feet. Otherwise it is apt to kick loose and escape.

The utility of sheep as scavengers of foul land can not be too fully recognized. With the exception of thistles, mullens, pawpaws, and the sprouts of the oak, walnut, and butternut, there is hardly any thing they will not browse, especially on thin uplands. They eat most sprouts and weeds best when they are tender in the spring (the poke is one notable exception); and if a field is very foul this is the time to turn flock after flock on it in rapid succession, stinting each a little temporarily, to make them consume the trash. When foul land has been burned over the sprouts which come up are much more relished by them than those on unburned land, the ashes seem to give them sweetness. This is the best method I ever found for clearing up old pastures which it was not convenient to plow.

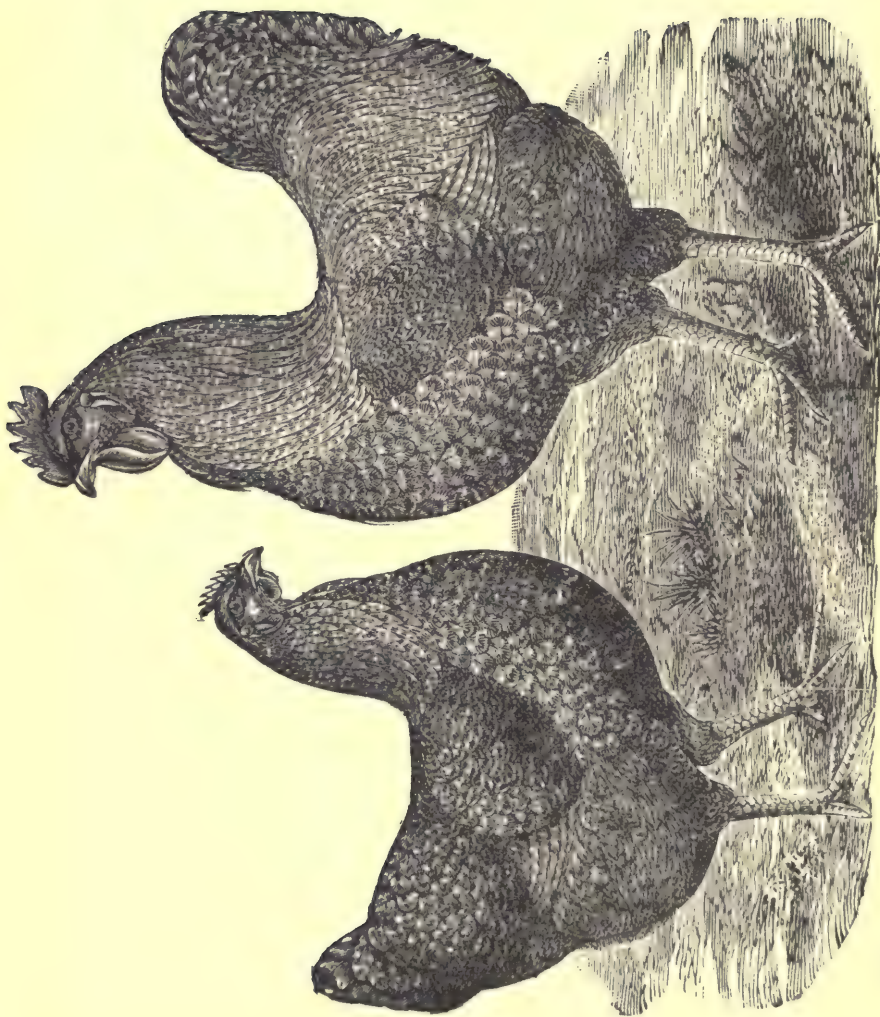
The evenness with which sheep-manure is distributed, and their tendency to accumulate it on the highest knolls (which are generally the poorest) are noteworthy points in their favor.

Indeed, these knolls will eventually become so enriched as to produce grass too rank for profit, when they will have to be inclosed and cropped.

Dogs.—As to sheep and dogs and the ravages of the latter, I have no statistics at hand but those of Ohio, as the Compendium of the Tenth Census gives no information on this subject. In 1882 the number of dogs in Ohio was returned at 170,911; the value of the sheep killed and injured by them was \$173,976. Therefore, a tax of one dollar on each dog, if fully collected, would not have reimbursed this loss, though it would probably have sufficed to pay all the actual claims for damages under the existing law.

Dogs always have been and always will be kept by mankind. The only practical question for legislators is, How to assess upon and effectively collect from their owners the damage caused by them. A law requiring the personal presence of the sheep-owner and one or more of his neighbors as witnesses, at the meeting of the commissioners at the county-seat, is burdensome and unjust. These claims ought to be relegated to the local officers, and the latter ought to be authorized to make allowance, not only for the sheep lost, but also sufficient to compensate the sheep-owner and his witnesses for the time spent by them in holding the inquest and going to make their affidavits.

An examination of the Ohio statistics reveals the fact that the number of sheep killed and injured by dogs, in a given county, bears no sort of relation to the number of sheep owned in the county. For instance, Licking—251,989 sheep; killed by dogs, 679. Lawrence—4,782; killed by dogs, 109. It is observable, as a general rule, that two classes of counties suffer the heaviest losses, viz., those which are most backward and non-progressive, and those which contain the largest cities, though this rule has some exceptions.



PLYMOUTH ROCKS.





AN UNWELCOME VISITOR.

CHAPTER XVIII.

POULTRY.*

IS Poultry-keeping Profitable?—When a sensible person is urged to engage in a new business, to extend a business already established, or to do any thing that will involve an outlay of time and money, the first question he naturally asks is: “Will it pay?” This is just as it should be, for either in pleasure, in cash, in health or knowledge gained, in the satisfaction derived from the knowledge that we have benefited others, or in some way, whatever we do must pay, or the pursuit will soon lose its charm, and the whole thing be a failure so far as we are concerned.

When the inquiry, “Will it pay?” is made in regard to the poultry business I am glad to be able to answer in the affirmative. I speak from several years of practical experience in

* “BY FANNY FIELD.”—The writer of our poultry chapter has proved, by her long continued success, her right to speak as authority on matters pertaining to the management of poultry. Her poultry farm contains sixty acres, on which is grown all the corn, oats, barley, sunflower seed, potatoes, cabbage, etc., required for the stock. The average amount of breeding stock kept is two hundred and sixty, mostly pure Plymouth Rock, but a few Light Brahmas and Partridge Cochins are also kept, as a cross of these breeds produces extra large cockerills for capons. About three thousand chickens are raised each year, two-thirds of which are sold as broilers. One hundred of the choicest pullets are selected each year to take the place of the same number of old hens that are disposed of. The best cockerells are caponized, and the remainder marketed early in the fall.

Ten hens and one cock of the pure Bronze Turkeys are kept for breeding-stock, and an average of one hundred and seventy-five per year are raised, and all sold to private customers for Thanksgiving. About three hundred ducks—pure Pekin—are raised each year and marketed as soon as they are large enough, and are usually out of the way by the middle of September. The policy is to market every thing as soon as it can be sold to advantage. About twenty-five hundred dozen eggs are sold yearly. The average annual sales from the farm for five years past are \$3,300, and the average expenses, including taxes, interest on capital, hired help, etc., \$1,800, leaving a net profit of \$1,500 per annum. The farm is valued at \$7,000.

poultry raising, when I say that poultry properly managed pays a larger profit in proportion to the capital invested than any other live stock on the farm. When every thing is sold at market prices poultry can be made to pay a profit of from one dollar to three dollars per head, according to locality, price of feed, etc.; and when, in addition to the market poultry business, one keeps thorough-bred poultry, and sells many of the eggs and fowls at fancy prices, a much larger profit can be realized.

Poultry on the Farm.—Poultry raising is a legitimate branch of the farm business—as much so as dairying or raising pork and mutton. With the farmer the question should not be, “Can I afford to keep poultry?” but, “Can I afford not to keep poultry?” The farmer can raise poultry cheaper than any body else, for the reason that he can give his fowls unlimited range, and there is no disputing the fact that the best and cheapest places to keep fowls are where they can have free range over as much of creation as they choose. In some localities fowls will, when allowed unrestricted liberty, pick up the greatest part of their living from the first of April until quite late in the fall. This foraging greatly lessens the cost of keeping, and also benefits the farmer, by greatly reducing the number of injurious insects.

Besides the good that fowls do by destroying insects, the farmer should consider that poultry manure is a valuable fertilizer, and if carefully saved in good condition, will go a long way towards paying the cost of keeping the fowls through the winter. Poultry manure is worth at any tannery fifty cents per bushel, and is worth much more than that for any crop to which it may be applied. Pound for pound, poultry manure is worth as much as the best commercial fertilizers in the market. Upon this subject Dr. Dickie says: “The most fertile part of many farms is that largely occupied by poultry. It is true that these portions are usually near buildings, and seldom utilized for growing crops; but when they are so utilized, the effects of the poultry droppings are plainly observable.”

In regard to poultry manure as a fertilizer for the corn crop,

the same writer says that he has grown six good crops of corn in six years in his poultry yard, the only fertilizer used being that deposited by the fowls themselves. From an experiment conducted on my farm I found that the manure from one hundred and fifty fowls in one year, mixed with nearly a ton each of plaster and road dust, made a quantity of fertilizers that from its effect on the corn and potato crops was pronounced equal in value to two tons of the phosphate, which cost, delivered at our depot, forty dollars per ton. The cost of this home-made fertilizer, including price of plaster, labor of collecting dust, etc., was about ten dollars per ton. I believe that in many localities the value of the poultry manure, in addition to the good that a flock of fowls will do by devouring grasshoppers, eggs of insects, the grubs of the curculio, etc., will balance the cost of keeping through cold weather.

Poultry should be kept on the farm if only to supply the farmer's table with an abundance of cheap, fresh meat at times when other meat can not be easily obtained. Poultry and eggs are the cheapest meats that farmers can get, and should appear on their tables oftener than they do.

As a final reason for keeping fowls on the farm, I would call the attention of farmers to the fact that the surplus poultry and eggs not needed for home consumption can always be exchanged for cash, or its equivalent. Farmers' wives will appreciate this if the men do not, for on many farms ready money is, during the greater part of the year, the scarcest imaginable article, and the farmer's wife, who does not have an income from the sale of poultry and eggs or butter, rarely has a dollar to call her own.

Poultry-keeping for Women.—Generally speaking, poultry-keeping pays better than any other money-making occupation that comes within the reach of women who live on farms or on small country places, and already there are many women in different parts of the country who are supporting themselves and their families, wholly or in part, upon the profits derived from poultry-keeping. What these women have done, other women can do, if they will; there is no reason why any

woman who desires to engage in poultry-keeping, either as a means of livelihood or to piece out a slender income, can not make it a pleasant and profitable pursuit—pleasant because profitable.

Poultry-keeping for Boys and Girls.—If for any reason the farmer does not desire to trouble himself with the care of poultry, I would advise him to turn the business over to the boys and girls. Loan them money enough to build a house, buy the fowls, and food enough to begin with; provide them with poultry books and papers, and give them the benefit of your advice and experience; require them to do all the work connected with the care of the poultry, to provide the food as soon as the fowls begin to pay their way, to keep correct accounts, and pay the money loaned as soon as possible. And you should pay them the market price for the poultry manure and for poultry and eggs used by the family. It is not at all likely that these young poultry-keepers will get rich in a hurry—they will probably blunder a good deal, and spend some of their money foolishly, but they will learn to help themselves, learn to like the farm and farm work, because they have an interest in it, and acquire business habits that will benefit them all their lives.

Number of Fowls that may be profitably kept on the Farm.—Just as many fowls may be profitably kept on the farm as the owner or some member of the family can find time to care for well. The best way for those who have had but little experience in poultry keeping is to begin with about twenty-five fowls, and increase the number each year until the flock numbers as many as can be cared for profitably.

Capital needed to start with.—But very little capital is needed to enable the farmer to start in the poultry business in a small way. In almost any part of the country good common hens can be bought for fifty cents a-piece, thorough-bred cocks for two dollars each, and the farmer who has lumber on the place, and can do the work himself, can by working at odd times put up a comfortable poultry-house without any cash outlay, except for nails and windows. In some places fowls are wintered, and profitably too, in sod houses and straw sheds, and the

writer thinks that any bright boy, who desires to try poultry-keeping, and can not afford to build a house, will manage to put up something of the kind, where the fowls can be kept until they earn money enough to pay for a more stylish residence. When one commences the poultry business in the spring with a stock of laying hens, it is not absolutely necessary to build a fowl-house till fall. Let the hens and chickens roost in the trees till cold weather.

Under the proper heading, I shall have more to say about cheap shelter for poultry.

Location.—When poultry raising is to be made the chief business of the farmer, the location is of no little importance. In selecting a farm for this purpose, convenience to market, the healthfulness of the locality, and the suitability of the soil for the cultivation of the grains and vegetables most needed by the poultry raiser should all be taken into consideration.

In selecting a site for the poultry-house, the one thing to be avoided is dampness. Damp houses and swampy yards are responsible for a goodly share of the ills that afflict chicken flesh. If the proposed site be not well drained naturally, drain it by artificial means; it will pay in the long run. In the colder parts of our country a southern exposure is best, and if the house can be so situated that it will be somewhat sheltered from the chilling winds and storms that come from the north and west, so much the better. South hillsides are capital places for poultry-houses, and when there is one on the farm it should be utilized for that purpose—provided it be within a reasonable distance of the other farm buildings.

Poultry-houses.—The chief points to be aimed at in the construction of a fowl-house are, plenty of room, warmth, light, and ventilation, without exposing the fowls to currents of air.

The *size* of the building must be determined by the climate and by the number of fowls to be wintered. In those parts of the country where the winters are so severe that the fowls must necessarily be confined indoors for three or four months, the poultry-house should contain three and a half square feet of floor room for every fowl; and connected with the house there should

be a shed, where the fowls can scratch and exercise during the day. The shed should cover nearly or quite as much ground as the main building, and should be constructed so as to keep out snow, rain, and wind, and admit plenty of light. But where the winters are so mild that fowls can run out of doors the greater part of the time, one-third less house-room will be sufficient, and the shed may be open on the least exposed side.

Concerning the *height* of poultry-houses, an experienced poultry raiser says: "I am dead set against low hen-houses. My belief is that all parts of it should allow a person of average height to walk erect; and I further believe that plenty of air space above the fowls is a vital necessity where a number are housed together."

Warmth is best secured by double boarding, with building-paper between; by double walls, with the space filled with tan-bark, chaff, or sawdust; by thick walls of stone or earth; and by building, whenever practicable, in sheltered situations. From my own experience, I can not recommend artificial heat in poultry-houses, except for raising early chickens. Fowls kept in houses artificially warmed during cold weather are very sensitive to cold, and consequently more liable to attacks of roup and kindred diseases than fowls wintered in houses where warmth is secured by natural means.

For *light* there must be plenty of glass in the south side of the house, and if there be a window in the east end to admit the morning sunlight so much the better. The windows should have shutters to close over them at night in cold weather, and should be protected inside by wire netting. By the use of the netting for the windows, and a screen door, the poultry-house can be converted into an open shed in summer, and will be much better for the fowls.

For *ventilation* there should be an opening at the highest point, near or in the roof, sheathed to exclude the storms, and an opening near the floor, so arranged that there will be no current of air to strike the fowls when on the roost.

Convenience should also be studied, and one of the most convenient things about a fowl-house is a passage-way, either

through the center or along the rear of the building, so arranged that the fowls can be fed and watered and the eggs gathered without entering the pens. By a simple arrangement of cords and pulleys the windows can be raised or lowered by pulling a cord in the alley, and the ventilators controlled the same way. On one side feed, oyster-shells, road-dust, plaster, etc., can be stored in narrow bins made for the purpose; and on shelves above the bins the disinfectants, medicines, and other things used in and about the poultry-house should be kept. Where a large number of fowls are kept, a stove for cooking food could be put up in the passage; and last, but by no means least, when the hens want to sit the nest-boxes can be turned so as to open into the passage-way, and the sitting hens can be fed free from annoyance by the other fowls.

The essentials of warmth, light, etc., secured, it does not matter much about the form of the poultry-house. One plan is as good as another, provided it comes within reach of the farmer's pocket-book, and in appearance harmonizes with the other farm buildings. In localities where lumber is scarce and high, and the new settlers are not overburdened with loose change, poultry-houses can be erected from the materials at hand—sods, straw, or prairie hay—without any cash outlay except for nails, glass, and window-sash. Such houses may not be very ornamental, but they can be made comfortable, and fowls will thrive and pay well in such structures.

The cheapest poultry-house that I ever saw was an immense straw shed that, as the owner remarked, "cost next to nothing." A skeleton frame was made of posts and poles, and then the straw was stacked over and around it to the depth of several feet, leaving the south side open. Rough boards were used to partition off a roosting-place at the back side, where the fowls were shut in at night, while during the day they scratched, cackled, and laid where they pleased in the immense shed.

A Nebraska farmer gives the following directions for constructing a cheap poultry-house: "Set three rows of posts in the ground, the center ones the highest. Nail pieces on top of each row of posts; spike on rafters made of saplings hewed at

the ends to fit; then board up inside and outside of the posts with rough boards, leaving places for the door and the windows. Fill the space between the boarding with prairie hay, straw, or chaff. The roof should be well thatched with prairie hay or straw, held down by poles or heavy brush."

On a Connecticut farm I once saw a cheap poultry-house that struck me as a very desirable building. It was twenty feet long, twelve feet wide, and ten feet high at the peak of the roof. The sides and ends, which were three feet above ground, were built of the rough stone that any body can get anywhere in New England for the hauling, and covered over with turf. Above this turfed wall was the steep roof, with two windows on each side. The roof was boarded and covered with tarred roofing felt fastened by narrow cleats. The windows were provided with straw mats and board shutters—ventilator in the center of roof. A passage-way through the center of the house, opened into four pens, two on each side. Cheap poultry-houses like those that I have described can be put up by any farmer who has or can hire a team, and can use an ax, hammer, and saw, and they will meet all the requirements of any well regulated family of fowls.

For the benefit of those who desire and can afford something better than the cheap buildings already described, I have selected a few plans that seem desirable.

Fig. 1 shows the elevation of a poultry-house that looks well enough and is good enough for the place of the wealthy farmer, while the cost of such a building does not put it out of reach of the farmer of moderate means. Most poultry-houses with a shed roof have the windows in the higher side, but this one is turned around—"hind side before" and represented with the windows in the lower side, which faces the south—a very sensible arrangement, and one that meets my hearty approval. A house like this may be extended to any length desired, and divided into pens to suit the convenience of the owner. It should be six feet high in the front, twelve feet or more—according to the width—in the rear, and wide enough to allow a passage way to the whole length of the building. The extra space

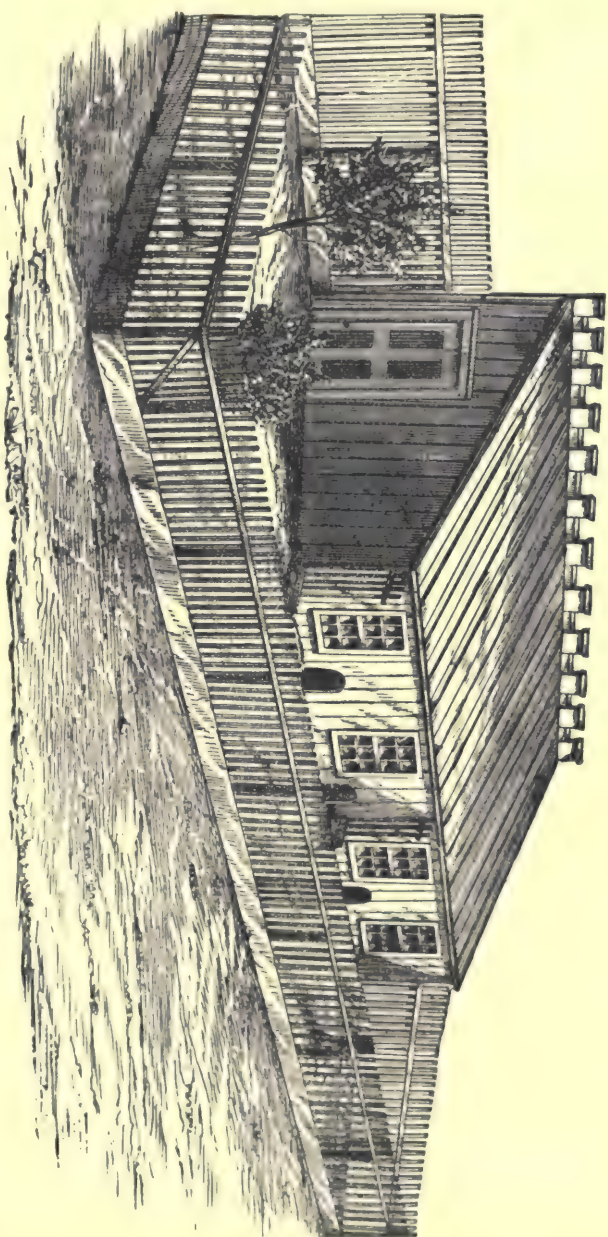


FIG. 1.—ELEVATION OF A GOOD POULTRY-HOUSE.

over the passage-way could be utilized by making a loft where chicken-coops, etc., could be stored when not in use; or it might



FIG. 2.—HILL-SIDE POULTRY-HOUSE.

be finished with a tight floor, and used for a roosting-place, the fowls reaching the roosts by means of steps or ladders, which will be described under the proper heading. With win-

dows in the roof a house like this would be capital for early chicks; in fact, for a general utility house it would be hard to beat; the only improvement that I would suggest would be a good shingle roof.

Fig. 2 shows the elevation of a hill-side poultry-house, and to the farmer who has the necessary hill-side I would strongly recommend a house of this kind.



FIG. 3.—LEAN-TO POULTRY-HOUSE.

Fig. 3 shows a lean-to poultry-house situated in the angle of a barn, a very desirable situation for a small poultry-house,

as it is sheltered on the north and west sides, and as fowls kept in a building connected with the barn can have the run of the barn-yard and manure cellar in winter, which gives them the exercise needed to keep them in good health.



FIG. 4.—FAMILY POULTRY-HOUSE.

Fig. 4 gives the elevation and Fig. 5 the ground-plan of a family poultry-house, fifteen by eighteen, that will accommodate from fifty to seventy-five fowls. *A* represents the laying-room; *B*, the roosting-room; *C*, the sitting-room, and *D*, a bin for grain. The nest-boxes are shown in the partition between the laying and sitting rooms, and are intended to slide back and forth. A house like this may be extended to any length, and a continuous passage way provided by changing the arrangement of the roosts.

Fig. 6 shows the front elevation, and Fig. 7 the ground-plan of a neat, substantial poultry-house that will meet the requirements of the farmer who desires to keep a large flock of fowls, and have rooms for raising early chicks. *d* represents the doors; *p*, the passage way; *w*, windows; *n*, nests; *r*, roosts, and *b*, dusting-boxes. The openings for the ingress and egress of the

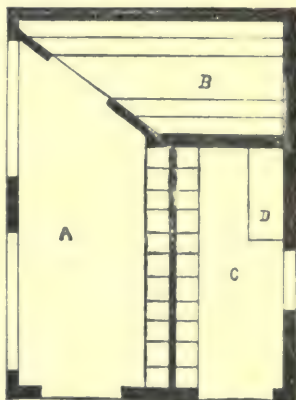


FIG. 5.

fowls may be beneath the windows in front, or somewhere in the rear. No ventilator is shown in the illustration, but there should be one in the roof of the main building, and one near the roof in the wing. This building may be of any length desired,



FIG. 6.—SUBSTANTIAL POULTRY-HOUSE.

and of course the inside arrangements may be varied to suit the fancy of the owner.

In addition to the plans given, I would suggest that the farmer who has a big barn cellar facing the south, and free from dampness, fit up a part of it for a fowl-house; a partition, door, and windows, roosts and other inside fixtures, and the thing is done.

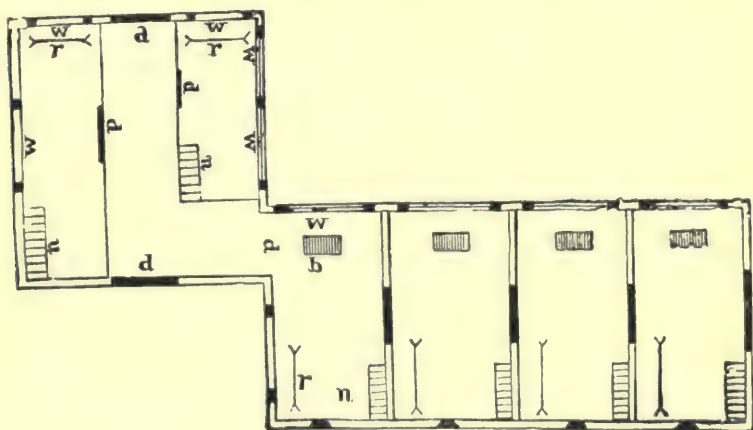


FIG. 7.—GROUND PLAN.

Inside Fixtures.—Nearly every poultry-keeper has his own views about the interior arrangement of a poultry-house, so that it will be necessary to give but few hints in that direction.

The main idea is to construct perches, nest-boxes, etc., so that they can be easily moved and cleaned. The perches, which should be sufficient in number to accommodate all the fowls without crowding, should all be on a level, for if one should be higher than the rest, every fowl will try to crowd on to that one. The perches should be flat rather than round, and of sufficient width to enable the fowls to rest comfortably. Until recently I followed the usual plan of placing the perches for the heavier breeds about eighteen inches from the floor, but I am now convinced that it is healthier for the fowls to roost in the higher part of the building, and the perches are placed accordingly. Heavy fowls are frequently injured, and sometimes

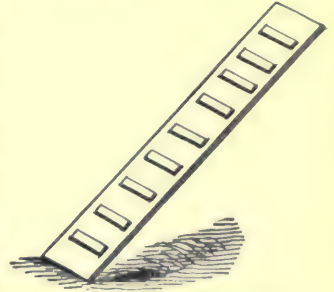


FIG. 8.—POULTRY STEPS.

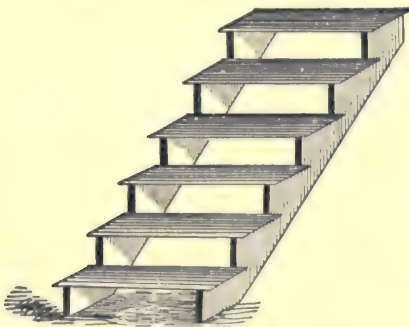


FIG. 9.—POULTRY STAIRS.

killed outright by jumping from high perches to the hard floor, and for this reason a ladder or steps of some kind should lead from the floor to the roosts. Figs. 8 and 9 show the construction of cheap, movable, "hen elevators." Underneath the roosts there should be a wide platform to catch the droppings, and under the platform the nest-boxes may be arranged so that the eggs can be gathered from the passage way.

For nests, boxes eighteen inches square, made like the one illustrated by Fig. 10, are the best that can be devised. They are easy to move and easily kept clean. When a hen offers to sit, face her box around, shove it into the passage way, and put another box in its place in the laying-room. For a dusting-bin, make a bottomless box, three by four feet, or of any desired length and width, and one foot in depth; fill two-thirds full with a

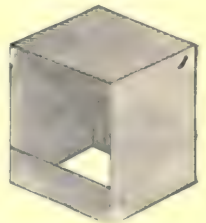


FIG. 10.—NEST-BOX.

mixture of two-thirds road dust, one-third perfectly dry wood or coal ashes, and a twenty-five cent package of carbolic powder. With the aid of this dusting-box and an occasional dosing of the roosts with kerosene, the fowls will keep themselves free from lice.

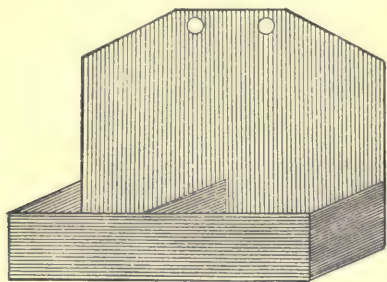


FIG. 11.—CHARCOAL AND SHELL BOX.

Another useful fixture in the poultry-house is a box like the one illustrated by Fig. 11. It should be hung on stout nails driven into the side of the house, and high enough from the floor to keep the fowls from scratching dirt into the contents. One compartment should be kept filled with bits of charcoal, and the other with crushed oyster shells.

Feed-boxes or troughs are a necessity. When food is thrown on the floor, or on any piece of board that comes handy, much of it is wasted, and besides, it is not what one might call a cleanly method of feeding. The feed-trough shown by Fig. 12 is as good as any that I ever tried, and has the merit of being quickly and easily made. Fig. 13 illustrates a feed-box that is



FIG. 12.—FEED-TROUGH.

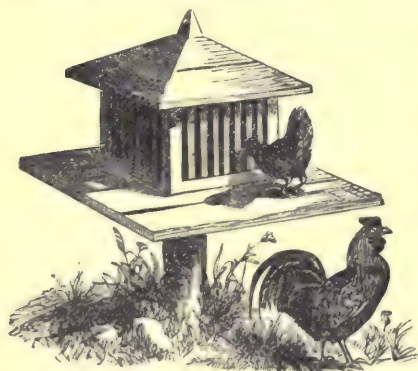


FIG. 13.—RAT-PROOF FEED-BOX.

proof against rats. The directions for making are as follows: "Make a platform two or three feet square; then make a box three inches high and sixteen inches square, and nail it firmly to the center of the platform. Saw strips one and one-fourth inches square and eighteen inches high for the posts at the corners; nail strips two inches wide to the posts at the top; then nail common lath to the top and bottom, leaving space of two inches between the slats. Make the roof as shown in the engraving, and separate so that

it can be raised to fill the box. Elevate this feed-box on a post about three feet from the floor or ground. The fowls will soon learn to leap upon the platform and feed from the box between the slats."

Drinking vessels of some kind are also a necessity in every well regulated poultry-house. Many and various are the "fountains" that have been invented by ingenious poultry raisers, but I have yet to see any thing that suits me any better than common glazed milk crocks of medium size. They are cheap, easily cleaned, high enough so that the fowls do not often scratch dirt into them, and yet low enough to enable them to drink easily. The fixtures illustrated by Figs. 8, 9, 10, 11, and 12 are in constant use in my poultry-house, and the drawings were made from them; but it is only fair to state that I obtained the idea from illustrations which appeared in the *Poultry World*.

Yards and Fences.—I believe that the farmer should, in order to make the most from his fowls, give them free range over the whole farm, except the door-yard and the garden; but at the same time it is necessary to have a yard connected with the poultry-house, where the fowls can be confined when occasion requires; and where the premises are small, neighbors close by, and the farmer desires to keep his fowl stock pure, it is better to keep the fowls in yards—otherwise the fowls, the neighbors' feelings, and gardens are apt to get in a hopelessly mixed condition.

When fowls are confined to yards, they should be divided into flocks of not more than fifty each, and each flock of that size should have half an acre of ground allotted to its use. This half-acre should be divided into two separate yards, to be used alternately. Keep the fowls in yard No. 1 one year, and grow a crop of some kind in No. 2. The next year put the fowls in No. 2, and cultivate No. 1. By following this plan the ground will be kept fresh, and can be used for fowls any number of years.

A portion of the yard occupied by the fowls should be plowed or spaded up every week during warm weather, so as to

give the fowls an opportunity to scratch in the fresh earth, and a chance at the earth-worms and bugs. To provide green food, partition off a portion of the yard by means of a movable lath fence, and within the inclosure sow oats and grass seeds. When the young plants are three or four inches high, remove the fence, and let the fowls help themselves while another crop is growing. In this way the supply of green food can be kept up till frost comes.

The young chicks each year can be raised in the yard with the growing crop. Confine the mother hens in coops placed near

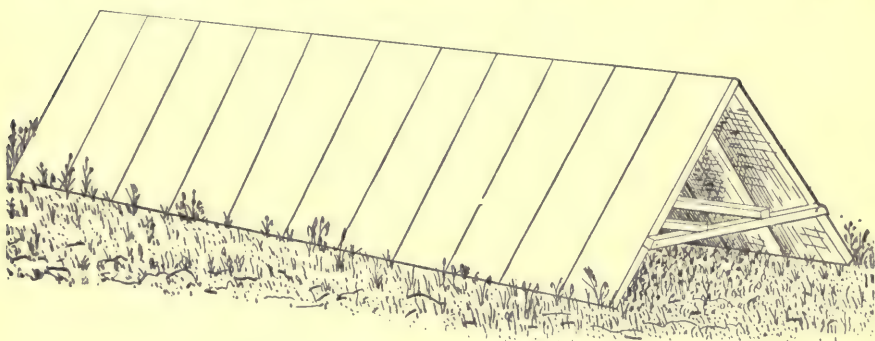


FIG. 14.—OPEN ROOSTING-SHED FOR YOUNG CHICKENS.

the fence, and let the chicks run; before they get big enough to do harm by scratching the crop will be out of their reach. After the chicks are weaned the coops may be removed, and open roosting-sheds, like the one shown by Fig. 14, put up. In these sheds the chickens can roost and find shelter in inclement weather until late in the fall.

Shade of some kind is an absolute necessity in the poultry-yard during the long, hot days of summer, and why not furnish it in the best way? Set out currant and gooseberry bushes, raspberry and blackberry vines near the fence all around the yard. These will furnish the shade that fowls like best, and at the same time give them a taste of fruit that they have a liking for. If there are no trees near the poultry-yard or house, set out a few plum-trees. While the bushes, vines, and trees are yet young, and until they are firmly rooted, the fowls should be kept from them by sharp stakes driven close around them.

Wood or coal ashes should be thrown around the bushes occasionally during the summer, for, besides making an excellent wallowing-place for the fowls, they greatly benefit the plants.

When the same ground is to be used for a poultry-yard for a number of years, I think it would pay to inclose the whole with a substantial picket-fence, which should be painted. There should be gates large enough to admit a one-horse wagon. But where the poultry-yard is changed to a new piece of ground every year or so, something in the shape of a

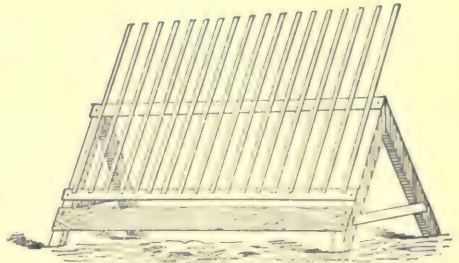


FIG. 15.—MOVABLE POULTRY-FENCE.

cheap, movable fence must be used. For this purpose I can recommend the movable fence without posts (Fig. 15), which was invented by Waldo F. Brown. I append Mr. Brown's directions for making this fence :

"The cut represents a panel eight feet long; the trusses are three and a half feet high; the six-inch board at the bottom we put six inches above the ground, and bank up to it with earth; the strips to which the lath are nailed are three inches wide. We use good plasterers' lath for the paling, and any waste pieces of board for the brace, which is nailed across from one upright to the other. The cut shows this brace to be but three inches wide, but it is better six or eight. The fence must be set up so that the lath all lean in, and this makes it very difficult for fowls to fly over it, as they must start some feet back to do so. The fence, as I make it, is five and a half feet high. I use oak, two inches square, for the uprights. In putting up this fence we set these panels down seven feet eight inches apart, and nail boards from one to the other on which to nail the lath, thus making each pair of trusses, as shown in the cut, make nearly sixteen feet of fence. As a two-inch upright is too narrow to splice on, we nail the boards on the top of the other boards, using nails long enough to go through both and hold in the uprights. After our fence is built we drive a good oak or

locust stake at each pair of trusses, and drive a nail through the brace-board into it. Most of these stakes need not be more than a foot above ground when driven, but it is well that occasionally a stake should come up to the top of the truss. This is to guard against the danger of the fence blowing over in a gale. The advantages of this fence are—1st. Its cheapness. The material for my fence cost fifty-five cents a rod. 2d. Nearly all the work of making it can be done under cover in stormy weather, and it can be set up when the ground is frozen or full of water, when it would be impossible to dig post-holes. 3d. It can easily be taken apart and moved if desired, and this is an advantage, for I think that if fowls are confined for years in one place the land becomes contaminated, and disease is the result. 4th. All round your poultry-yard you can, with a little trouble and expense, make coops for your broods, or protection for nests. A nest-box may be set under the leaning fence at any place, and a couple of short boards leaned up outside, and it affords shelter and seclusion

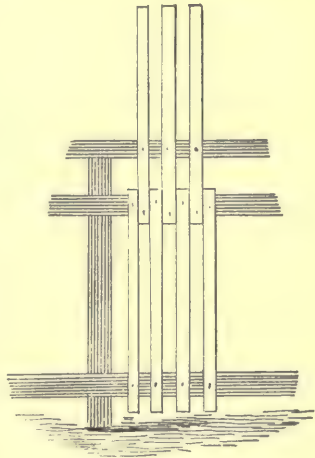


FIG. 16.—LATH FENCE.

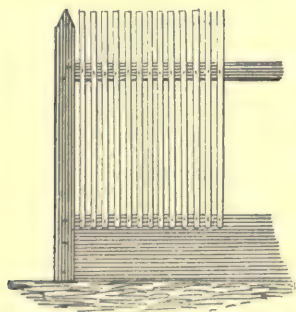


FIG. 17.—DIVISION LATH FENCE.

for the nest. Each eight foot space, when inclosed, makes a safe and roomy coop for a brood. I feel sure that all who confine their poultry will be pleased with this fence if they will give it a trial."

The only alteration that I would suggest is to have the bottom board a foot wide, and let it come to the ground, instead of using a six-inch board six inches above ground and banking up,

as recommended by Mr. Brown.

When a fence is desired to confine the smaller breeds of fowls, try the lath fence illustrated by Fig. 16. It makes a fence eight feet high, and if the fowls fly out over that, clip

their wings. Fig. 17 illustrates a lath fence that will come handy for division fence for the inside of poultry-yards and houses. It can be made in continuous panels of any desired length, and may be fastened to posts by means of wire or stout cord.

Best Breeds for Special Purposes.—Farmers who have had no experience with the different varieties of pure-bred fowls are very apt to choose a breed because they “like the looks” of the fowls, or because somebody says that particular breed is “the best;” but it frequently happens that their poultry fails to pay, because the breed selected is not the one best adapted to the special purpose for which they keep fowls, and disappointment results.

Our illustrations of the different breeds are true to life, and will give a good idea of the appearance of the fowls. If the profit is to be derived from eggs alone, some of the non-sitters will be most satisfactory. If broilers for the early market, a breed that feathers young, like the Plymouth Rock, will be found profitable; while for capons crosses are often found to give the best results. As a rule, it will be more profitable to keep some one pure breed rather than a mixture of all sorts, as is often found on the farm.

Before making a choice from among the many different breeds, each of which somebody will declare is “the very best,” the farmer should decide what particular branch of poultry raising will probably pay best in his locality; whether he will make a specialty of eggs, spring chickens, capons, dressed poultry for the fall and winter market, or whether he will go into the “general utility” branch of the poultry business, and make all the profit possible from eggs, chickens, and fowls. In making this decision he will, of course, be governed by the market facilities in his locality, and by the time and help at his command. These points settled, and a little knowledge of the different breeds acquired, the selection of a profitable breed will be an easy matter. From her own experience with the different breeds, and from the best practical authorities on the subject, the writer submits the following :



SILVER-PENCILED HAMBURG COCK.



SILVER-PENCILED HAMBURG HEN.

Hamburghs and Leghorns will lay a greater number of eggs in a year than fowls of any other breed, and, generally speaking, are just the fowls for the farmers who care nothing for the size of fowls or eggs, but only desire fowls that will produce the greatest number of eggs for market.

There are six varieties of Hamburghs—White, Black, Golden - penciled, Silver - penciled, Golden - spangled, and Silver-spangled—and each variety has its champions; but the truth

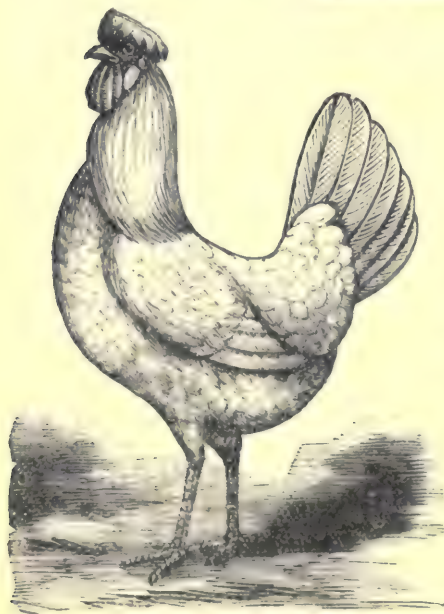
of the matter is that one variety does not differ much from another except in color of plumage. The illustration of Silver-penciled Hamburgs on the preceding page gives a good idea of the shape and general appearance of the whole Hamburg family. The Silver-penciled Hamburgs were formerly known as Bolton Grays and Creoles, and both the penciled varieties were often called



WHITE LEGHORN COCK.

“Dutch Everlasting Layers.” The Spangled Hamburgs are the old-fashioned pheasants, improved and named over.

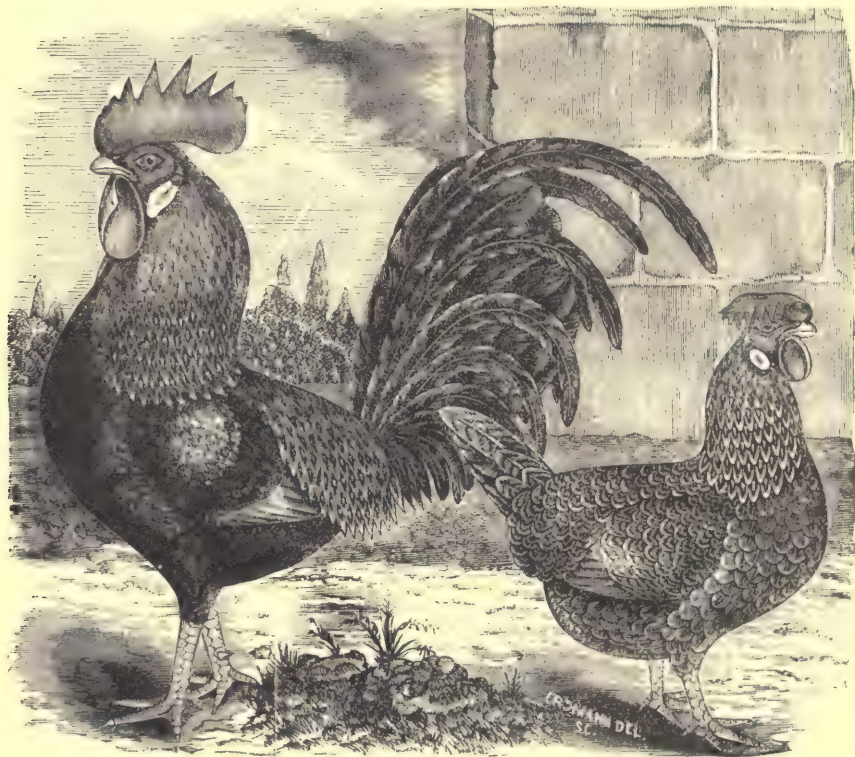
The Leghorn family is also divided into six varieties—White, Brown, Black, Dominique, Rose-comb White, and Rose-comb Brown—differing from each other only in matter of comb and color of plumage. On this page we give a fair illustration of the Single-comb White Leghorn cock, and also a hen of the same breed.



WHITE LEGHORN HEN.

The illustration on this page well represents the Brown variety. The only superiority claimed for the Rose-comb over the Single-comb varieties is that the Rose-combs are handsomer and not so liable to freeze in extreme cold weather.

All the different varieties of Leghorns and Hamburgs are small, active, non-sitters, and are great layers. Their eggs



BROWN LEGHORNS.

are smaller than those of other breeds; but that is not a serious drawback, for in most markets "an egg is an egg," regardless of size.

The Houdans, La Fleche, and Black Spanish are the best breeds for those who want non-sitting hens that will lay good-sized eggs. The Houdans (see illustration) are of medium size, great layers, and, on account of the large quantity of breast-meat and small bones, excellent table-fowls. Chicks of the breed are very hardy, feather early, and mature rapidly.



HOUDAN COCK.

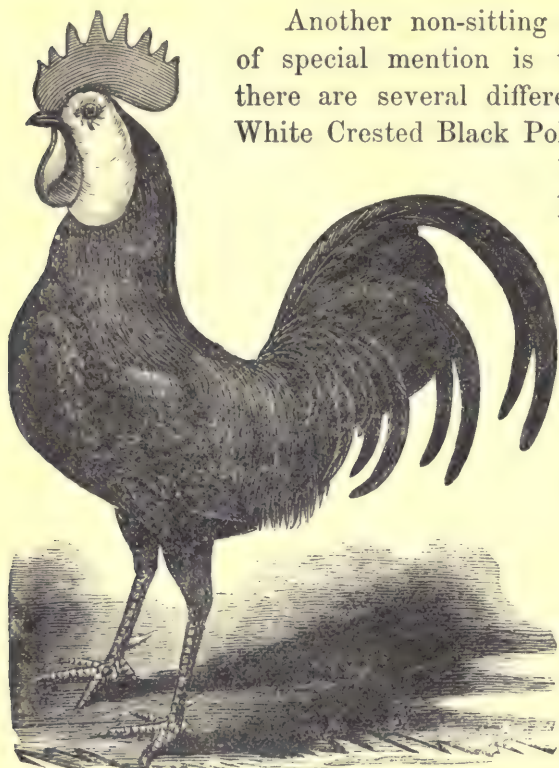


HOUDAN HEN.

The La Fleche are medium-sized, black-plumaged fowls, and worthy of more attention than they have hitherto received from farmers.

The White-faced Black Spanish (see illustration, page 1064) are of medium size, and are great layers of large eggs.

All three breeds are alike in that they require unlimited range, and, generally speaking, lay better in spring and summer than in winter.



WHITE FACE BLACK SPANISH COCK.

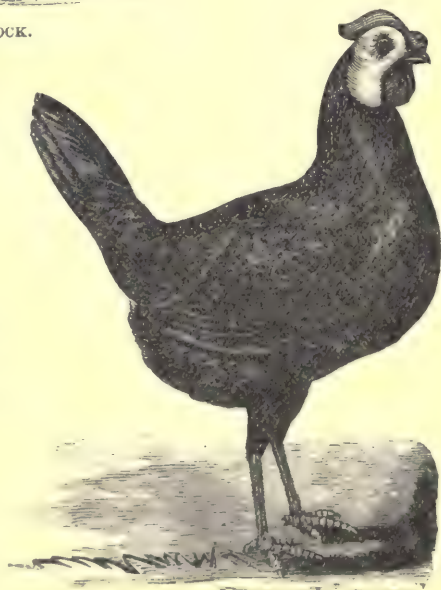
Another non-sitting breed that is worthy of special mention is the Polish, of which there are several different varieties, but the White Crested Black Polish are the oldest and best known. (See illustration, page 1065.)

For capons choose some of the large breeds, or a cross produced by mating pure Light Brahma hens with Partridge Cochinchin cocks. Chicks from this cross make extra large fowls, but it is only the first cross that is desirable; if the half-breed fowls are bred to-

gether the stock will rapidly degenerate. Caponize the cockerels and fatten the pullets for the fall and winter market, when they will bring a good price.

For winter layers and fowls to sell dressed, for the fall and winter market choose Brahmas, Cochins, Langshans, or Plymouth Rocks.

The Light Brahmas are larger than fowls of any other pure breed, and on account of their size, great beauty and



WHITE FACE BLACK SPANISH HEN.



WHITE CRESTED BLACK POLISH COCK.

many useful qualities, rank high in public favor. The cut on page 1066 represents a pair of Light Brahma fowls.

The Dark Brahmas equal the Light in beauty of form and feather, possess the same useful qualities, and rank next in size. The cut on page 1068 is a perfect representation of a pair of Standard Dark Brahmas.

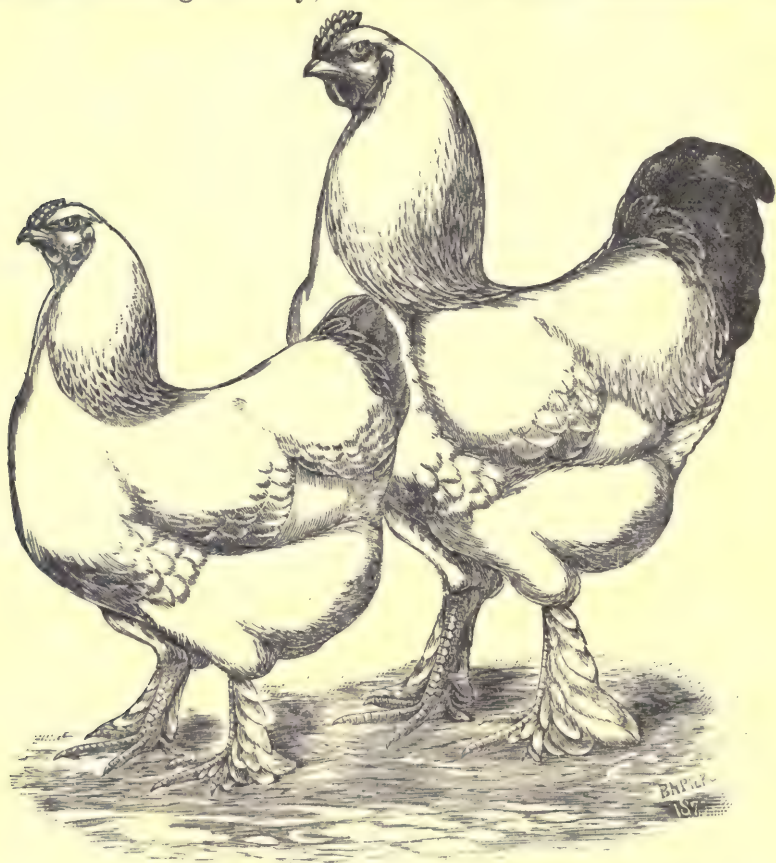
The Partridge Cochins stand at the head of the



WHITE CRESTED BLACK POLISH HEN

Cochin family. They are extremely hardy, mature rapidly, and are unsurpassed as winter layers. (See illustration, page 1067.)

The Black and the White Cochins are somewhat smaller than the Partridge variety, and rank next in usefulness. The

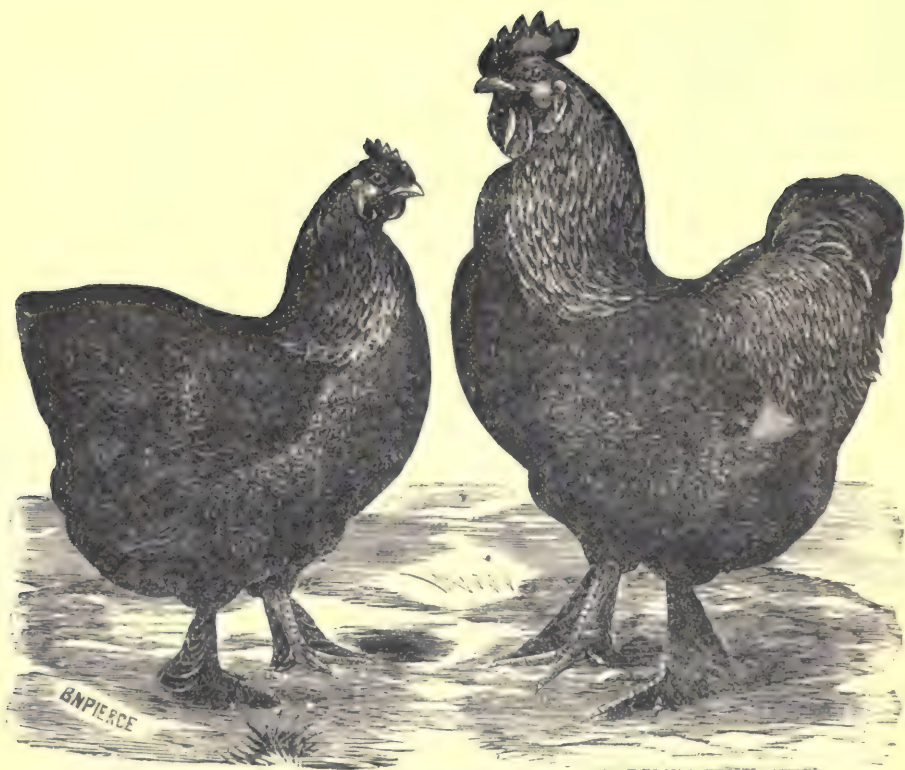


LIGHT BRAHMAS.

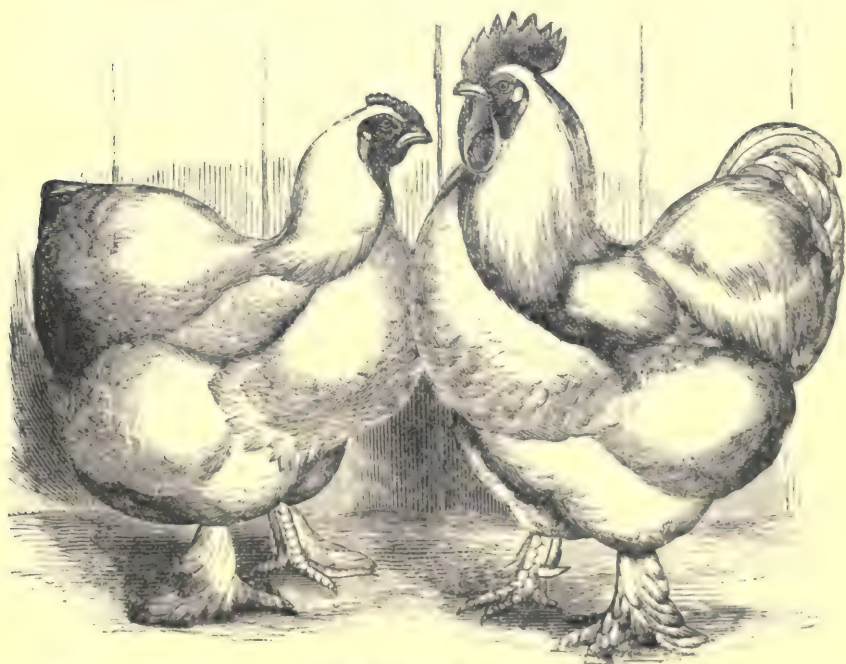
cut on page 1067 is a good representation of a pair of White Cochins.

The Buff Cochins are favorites with fanciers, but as they have the reputation of being poor layers they are not so popular among farmers as the other varieties of the Cochin family. They are very quiet and docile, and as sitters and mothers can not be excelled by any thing that wears chicken feathers.

The Langshans (see illustration, page 1069) are not so well



PARTRIDGE COCHINS.



WHITE COCHINS.

known in this country as the other Asiatic breeds, but are generally liked by all who have given them a fair trial.

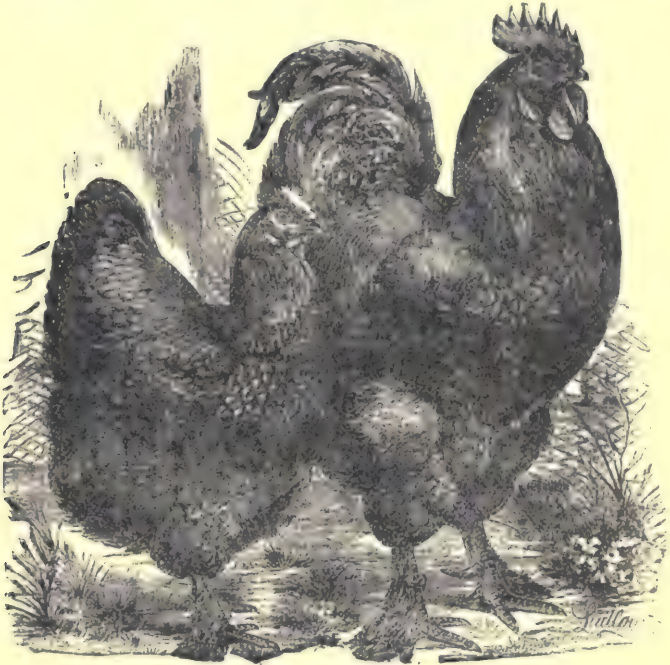
The Brahmas, Cochins, and Langshans are all good market



DARK BRAHMAS.

fowls, bear confinement well, quiet and gentle in disposition, easily fenced in or out, good sitters, careful mothers, and with the exception of the Buff Cochin, good winter layers.

Plymouth Rocks, Dominiques, and Wyandottes are the breeds for the poultry raisers who desire to raise chickens for the early spring market. Chicks of such breeds are hardy, and feather up quickly, making nice broilers at from eight to twelve weeks of age. The Plymouth Rock (see frontispiece page 1040)



LANGSHANS.

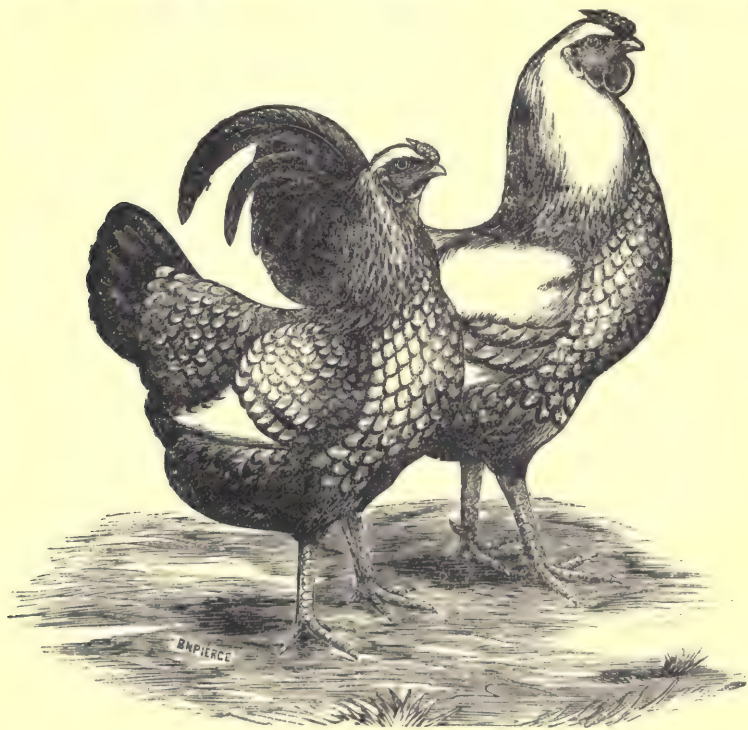
is the best "general-utility" breed for the farmer. Fowls of this breed are hardy, active, good for eggs all the year round, good sitters and mothers, and good for fall and winter market.

The Dominiques rank next to the Plymouth Rocks as farm fowls, and in color of plumage closely resemble that breed. Dominiques are somewhat smaller than the Rocks, and have rose instead of single combs.

The Wyandottes (see illustration, page 1070) have been but recently admitted to the standard, but they stand high in popular favor, and are destined to take their place among farm and market fowls.

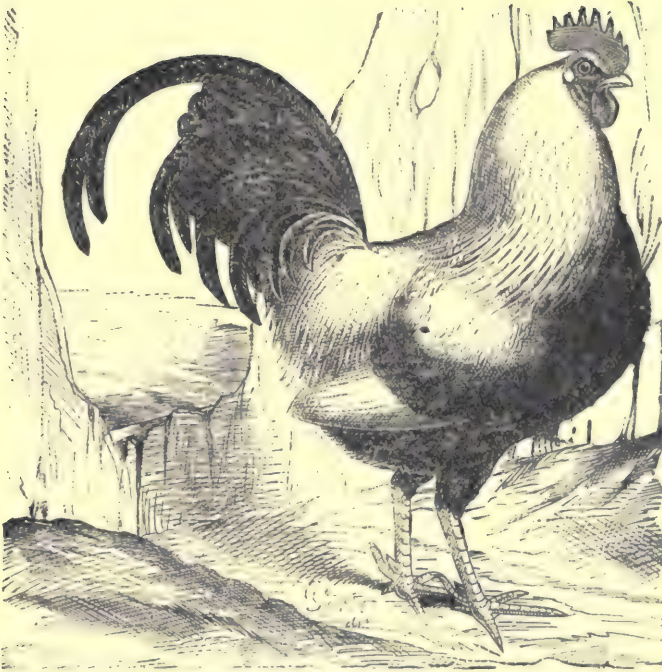
For table fowls the Houdan and the Dorkings, the English and French market fowls, are by many considered superior to

all other breeds. It is claimed that the flesh of fowls of this breed is superior to that of other fowls, but in the humble opinion of the writer the "sweetness, richness, delicacy, and peculiar flavor" claimed for the flesh of fowls of any breed is more the result of the keeping, and the way they are cooked than any thing in the breed itself. But the Houdans certainly have small bones and carry a large quantity of breast meat, and the Dorkings also carry a large proportion of meat on the parts that are gen-



WYANDOTTES.

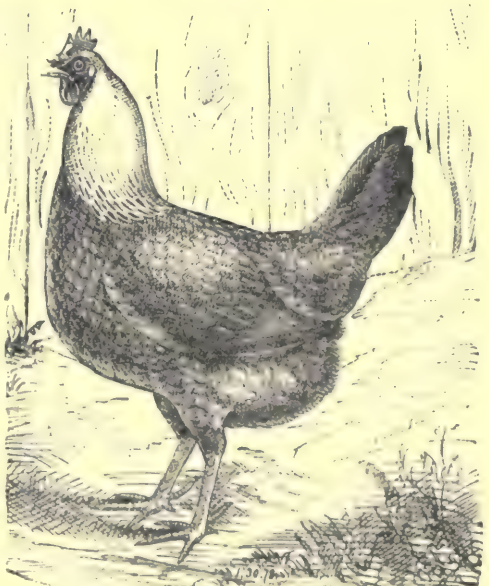
erally liked best; so, for these reasons, the farmers whose chief object in raising poultry is to supply their own tables with an abundance of fresh meat will probably like these breeds and find them profitable, and it sometimes happens that the poultry raiser gets hold of a class of private customers who have a notion that the flesh of fowls of this or that breed is superior to all others, and, in such cases, he should aim to please his customers—especially when, by so doing, he can get two or



SILVER-GRAY DORKING COCK.

three cents more per pound for his poultry. Dorkings are nothing extra for layers, and chicks of this breed are hard to raise, except in localities where the soil is dry and warm. The illustrations on this page represents a pair of Silver-gray Dorkings.

The different varieties of game fowls are hardy, active, good foragers, good layers, good sitters, excellent mothers, and highly esteemed as table fowls, but on account of their fighting proclivities I can not recommend them for farm fowls.



SILVER-GRAY DORKING HEN.

The different varieties of Bantams are classed among the ornamental fowls, and are chiefly desirable as pets for the children. The illustration on this page represents a pair of Japanese Bantams.

Improve the Common Fowls.—The farmer who can not afford to stock up with fowls of pure blood should do the next



JAPANESE BANTAMS.

best thing—begin with common fowls and improve the stock as he goes along. This can be done at little expense. The first year mate the best of the common hens and pullets with young cocks of the pure breed best suited to your purpose;

the second year mate the same cocks with the best of the half-breed pullets; the third year get young cocks that are not closely related to the old stock. By adhering to this plan of keeping only the very best of the cross-bred pullets each year, and using only pure bred cocks, the common stock can be crossed out of existence in a few years, and in their place will be a stock of fowls that for all practical purposes will be just as good as those of the pure blood.

Choice of a Cock.—In choosing a breeding cock be sure that he is in good health, comes of healthy parent stock, and is free from deformity of any kind. Pay some attention to symmetry—*i. e.*, choose a well-proportioned bird. A mature cock that seems to be all legs and neck would not be desirable for a breeder. Never buy or keep a cock that has a cowed look and runs upon the approach of other cocks, but select one that carries his head up, steps as if he owned the whole poultry-yard,

and stands ready for fight when molested by other male fowls. Such cocks possess strong constitutions, and will surely transmit their good qualities to their descendants.

Eggs, or Market Poultry.—"Which is the most profitable, eggs, or market poultry?" is one of the questions that those who contemplate going into the poultry business are sure to ask, but it is not difficult to answer. Where the average price of eggs is twenty cents per dozen, the farmer can profitably keep fowls for eggs alone—*i. e.*, if he will get some of the best hens of the non-sitting breed, run them on the high pressure plan until their days of usefulness are past, then send them to market and stock up again with pullets. But in localities where the average price goes much below twenty cents the poultry raiser should not depend on eggs alone for his profits. He should get some one of the larger breeds, hatch the chicks early so as to have pullets of a suitable age for fall and winter layers, sell the surplus cockerels as soon as they are large enough for broilers, and manage to turn off the old fowls when they will bring the highest price. From one-half to two-thirds of the old hens should be disposed of each year, and their places filled by pullets.

Management of Laying Hens.—It is an easy matter to care for laying hens in summer; a clean, well ventilated roosting-place, free range if possible, a place where they can scratch and dust themselves in dry earth, plenty of fresh water, and the necessary amount of food, is all that the most exacting fowls require to keep them in good laying trim. When allowed free range and insect forage is abundant, the fowls will thrive and lay well on two scant meals each day. In the morning give a light feed made of the scraps from the kitchen wet with boiling water and thickened with wheat-bran; at night, a little corn, oats, or wheat.

When confined, even to quite large runs, more food and a greater variety will be necessary. Green food and meat of some kind must also be given every day. The most acceptable green food for fowls in confinement is chippings of young and tender oats, grass, and millet. When plenty of milk can be had the

meat will not be necessary, for the milk will take the place of the insect food that the fowls get for themselves when at liberty. But to make hens lay in winter is a different thing, and often taxes the skill of the poultry raiser to the utmost. To begin with, the pullets that are expected to lay in cold weather must be of the right age to commence laying in October, when, with proper care, they will lay right along till February, and by that time, or before, the old hens that have been wintered over will be ready to begin. For winter layers the Brahmas, Cochins, and Langshans should be out of the shell in February and March; Plymouth Rocks should be hatched in March and April, while the smaller breeds should be hatched later, say from the middle of April to the middle of May. The smaller breeds mature earlier than the large breeds, and if hatched very early in the season will commence laying about the first of August, lay out their first litter, and be ready to rest just as the price of eggs begins to go up; then cold weather comes on, and it will be a hard matter to induce them to commence laying again much before February.

The absolute necessity of having a comfortable house for laying hens in localities where the mercury is liable to go a long distance below zero has been spoken of under the proper heading, and need not be enlarged upon here.

Given the house and the hens, the next things are the food and drink. Every morning, as soon as the fowls come from the roost they should have a warm breakfast made of boiled vegetables mixed with corn-meal, oat-meal, bran, or shorts—sometimes one thing sometimes another, taking care not to feed too large a proportion of corn-meal. Give as much variety as possible, and season all soft food with salt and pepper as you would for your own eating, and don't make this soft food sloppy; it should be just moist enough to hold together. At noon give the fowls a few handfuls of buckwheat or sunflower seed scattered among the litter in the shed or other place where they exercise. This noon meal is given more to make the fowls exercise by scratching it out of the litter than for any thing else. At night give a liberal feed, as much as they will eat up clean, of grain of

some kind. In the colder parts of the country this night feed may be of corn at least two-thirds of the time.

Meat, or something that will take the place of the bugs and worms that the fowls get in summer, must be given daily. We have followed the plan of hanging a big piece of raw, fresh meat where the fowls could reach it, and we have yet to see any ill effects from feeding meat that way. We get livers and other cheap pieces of meat from the butcher twice a week, and like it much better than the steamed meat that is prepared expressly for fowls. A more economical way of feeding meat would be to boil it and mix it with the morning feed. When plenty of milk can be had, and a little sunflower seed, which is rich in oil, given daily, the meat may be dispensed with.

Fowls need drink in cold weather, and when water or milk can not be kept by them all the time it should be supplied regularly twice a day.

Green food is another one of the essentials, and must be supplied regularly every day. The very best green food for fowls of all kinds in winter is oats, grass, and millet, that was cut when young and cured just enough to keep—cut fine and soaked in hot water or steamed. If the fowls don't take kindly to it at first, sprinkle with corn-meal or bran. The next best thing in the way of green food is cabbage; fasten the heads up where the fowls can reach them, and let them help themselves. Of course, this will not be practicable when the temperature of the house is below the freezing point. When nothing else is available feed chopped apples, potatoes, turnips, and carrots.

Besides the necessary food and drink, the winter laying fowls must have a supply of gravel and crushed oyster-shells, or lime in some form; and if you can give a little raw, crushed bone twice or three times a week, it will do more towards filling the egg basket than any or all of the patent "egg foods," and it won't hurt the fowls by over-stimulating them. Get fresh bones right from the butcher, and by some means reduce them to bits of a suitable size. The old way was to break them up with the head of an old axe, but now the poultry raiser can get hand-mills that will do the work. When given three times a

week a pint of this ground bone is enough for a dozen fowls. An occasional feed of burned bones is also excellent for laying hens.

The Best Market for Eggs.—In regard to the best market for eggs, that is a question that every poultry raiser must settle for himself. He must study the market reports of the cities that are within his reach, find out the cost of transportation, and then compare with the price of eggs in his locality. In some localities the nearest city market will be the best; in others, it will pay better to ship to some distant city; while some farmers may find it more profitable to sell eggs to private customers in the nearest village. In regard to the New York market, it is quite practicable to ship eggs in prime order from Ohio, Indiana, Illinois, and points farther west to New York; but before sending eggs such long distances the poultry raiser should look well to his home markets, and take every thing into consideration. Eggs that travel long distances to reach the New York market seldom sell so readily, or bring so good prices in that market, as eggs from near-by points. The average prices of Western eggs in New York rule from three to five cents per dozen lower than those from New York State, New Jersey, and Pennsylvania; but in this connection it is proper to state that the majority of the Western eggs, owing to unskilled packing, reach New York in a very bad condition. If the eggs were fresh to begin with, and properly packed, they would reach market in much better shape, and a higher price would be realized.

How to get the Highest Price for Eggs.—The poultry raiser or farmer who sells eggs to private customers in the nearest city or village should call regularly every week or two weeks, as best suits the convenience of his customers, and always sell clean, fresh, fair-sized eggs. By so doing he can command a few cents per dozen above the market price.

For city markets the eggs should be packed in crates or barrels, and shipped regularly every week to some reliable commission house. The shipper should have some particular brand or mark which should be on all his packages, should warrant every egg fresh, see that they are so, and his brand of eggs

will soon be in demand at the highest market price. When his brand of eggs becomes well known, and his reputation for selling honest goods is firmly established, he may, by looking around a little, obtain a chance to ship eggs direct to a hotel or restaurant, and thereby get a few cents per dozen above the market price, besides saving commission charges.

For the New York market, generally speaking, it is best to pack in crates holding from thirty to forty dozen, or in ordinary flour barrels, which hold from sixty to seventy dozen each. A New York commission merchant furnishes the following directions for packing eggs in barrels :

“Use strong, stiff barrels, put four inches of packing evenly over the bottom of the barrel (use *fine* kiln-dried cut straw or wheat-chaff; *never use oat or buckwheat chaff*), then a layer of eggs laid upon the sides, evenly embedded in the packing, with the ends towards the barrel, but about three quarters of an inch from the staves; cover the layer with packing to the depth of one inch, and rub well in between the eggs with the hand. After each two or three layers they should be well settled by using a plank follower and shaking the barrel. Put about four inches of packing over the last layer. In heading great caution should be used in having the head-press firmly on the packing so that the eggs can not work loose in the barrel by handling, but it should not press so tight as to break them. In winter, to guard against frost, use more packing and leave the eggs farther from the stave. The count should be carefully made and correctly marked on the barrel.”

Concerning western eggs the same commission man says :

“Be sure (especially in summer) that your eggs are not only sound, but recently laid. Eggs may be ‘candled’ and repacked at the West, but if they are *stale*, though apparently sound, they will be sure to reach this market in bad order, or will so rapidly change on being opened that dealers will be sure to lose money on them. The motion of the cars over such long distances so muddles all eggs not strictly fresh that they appear cloudy and stale, and will soon spoil, if, indeed, they are not already bad. Do not hold lots after they are packed. Ship at

once while fresh. Send by express from the first of June to the middle of September; at other seasons of the year they can be safely sent by fast freight lines."

For any market the eggs should always be *clean*, and the crates and barrels should present a neat, fresh, attractive appearance.

Preserving Eggs.—Eggs can not be kept "fresh" for any great length of time, but if properly put up they can be kept "good" for some months, and a great deal of money is made every year by dealers who buy up eggs when they are cheap, lime them, and hold until the price goes up. The following (from the third report of the United States Butter and Cheese Association) is the method of liming most used by dealers:

"To make a pickle use stone lime, fine salt and water, in the following proportions: One bushel of lime, eight quarts of salt, twenty-five ten-quart pails of water. The lime must be of the finest quality, free from sand dirt—lime that will slack white, fine, and clean. Have the salt clean and the water pure and sweet, free from all vegetable or decomposed matter.

"Slack the lime with a portion of the water, then add the balance of the water and the salt. Stir well three or four times, at intervals, and then let it stand until well settled and cold. Either dip or draw off the clear pickle into the cask or vat in which it is intended to preserve the eggs. When the cask or vat is filled to the depth of fifteen or eighteen inches, begin to put in the eggs, and when they lie say about one foot deep, spread around over them some pickle that is a little milky in appearance, made so by stirring up some of the very light lime particles that settled last, and continue doing this as each lot of eggs is added. The object of this is to have the fine lime drawn into the pores of the shells, as they will be by a kind of inductive process, and thereby completely seal the eggs. Care should be taken not to get too much of the lime in; that is, not enough to settle and stick to the shells of the eggs, and render them difficult to clean when taken out. (The chief cause of thin, watery whites in limed eggs is that they are not properly sealed in the manner described. Another cause is the putting into the

pickle old, stale eggs that have thin, weak whites. When the eggs are within four inches of the top of the cask or vat, cover them with factory cloth, and spread on two or three inches of the lime that settles in making the pickle, and it is of the greatest importance that the pickle be kept continually up over this lime. A tin basin (holding about six or eight dozen eggs), punched quite full of inch holes, edge muffled with leather, and a suitable handle about three feet long attached, will be found convenient for putting the eggs into the pickle. Fill the basin with eggs, put both under the pickle and turn the eggs out; they will go to the bottom without breaking.

“When the time comes to market the eggs, they must be taken out of the pickle, cleaned, dried, and packed. To clean them, secure half of a molasses hogshead, or something like it, and fill the same about half full of water. Have a sufficient number of crates of the right size (to hold twenty or twenty-five dozen eggs), made of laths or other slats, placed about three-quarters of an inch apart. Sink one of these crates in the half-hogshead; take the basin used to put the eggs into the pickle; dip the eggs by raising it up and down in the water, and, if necessary to properly clean them, set the crate up, and douse water over them. Then, if any eggs are found when packing that the lime has not been fully relieved from, they should be laid out, and all the lime cleaned off before packing. When the eggs are carefully washed they can be set up or out in a suitable place to dry, in the crates. They should dry quickly, and be packed as soon as dry. In packing, the same rules should be observed as in packing fresh eggs.

“Vats built in a cellar around the walls, with about half their depth below the surface, about four or five feet deep, six feet long, and four feet wide, are usually considered the best for preserving eggs in, although many use and prefer large tubs made of wood. The place in which the vats are built, or the tubs kept, should be clean and sweet, free from all bad odors, and where a steady, low temperature may be maintained—the lower the better; that is, down to any point above that of freezing.”

Another method, recommended by W. H. Todd, and used by some dealers :

“To four gallons of boiling water add half a peck of new lime, stirring well; when cold strain through a coarse sieve to remove lumps, and then add ten ounces of cream of tartar, mixing thoroughly. Let the mixture stand two weeks before using. Pack the eggs closely in any thing that will hold the mixture, and keep all covered with the pickle. Keep in a cool place.”

Another method is to pack the eggs, small end downwards, in dry bran, and keep in a temperature but just above the freezing point. Still another method, practicable only for keeping a few dozen for home use, is to wash the eggs perfectly clean, pack in jars, and pour melted lard or tallow over them until the jar is full. Perfectly fresh eggs, packed small end downwards in dry salt, and kept in a cool place, will keep good for six months.

For any method of packing the eggs should be perfectly fresh, and those from yards where no male fowls are kept will keep longer than those that have been impregnated.

Limed eggs, or eggs that have been “preserved” in any way, never sell so high as strictly fresh eggs; but the best of them usually sell at prices that enable the dealer to double the money invested.

Spring Chickens.—Spring chickens command the highest prices of any market poultry, and as the demand for this class of poultry is constantly increasing I would call the attention of farmers who live within a reasonable distance of a city market to this very profitable branch of the poultry business.

Chicks for broilers are hatched from the middle of January to the middle of May, and sent to market when from eight to twelve weeks old, or when they will weigh from one and one-half to two pounds a-piece alive, or from one to one and one-half pounds dressed.

The cost of hatching and raising these chicks to a marketable age varies from fifteen to twenty-five cents per head, according to locality, season, price of feed, etc. The prices

obtained also vary according to locality and season. Very early in the season broilers sell in Boston, New York, and Philadelphia as high as seventy-five cents per pound dressed, or from one to two dollars per pair alive. Later in the season the price declines, and customers demand greater weights; but, generally speaking, broilers can be sold at a profit up to the middle of July or first of August. Of course, every body can not market their spring chickens in the cities named, but there is not a city of any consequence in the United States where prime broilers can not be sold in season at paying prices.

Spring chickens, to command the highest prices, must be plump and well feathered, and, if sold dressed, must be dressed neatly, and put up in good shape.

The best way to go into the spring-chicken business, or any other branch of the poultry business, is to begin in a small way, make it pay as you go, and work up until there is all that one pair of hands or one family can manage profitably. Many fail in this, as in other things, because they attempt too much to begin with. Remember that it is more profitable to raise twenty dozen prime broilers than it would be to raise twice that number of inferior ones. The best will always sell at paying prices, even when the market is overstocked with poor poultry, while the latter often sells for barely enough to cover the cost of transportation and commission charges.

Eggs for Hatching.—In selecting eggs for hatching, remember that the newest laid are the best, and that those from the second litter are better than the first laying. Eggs from the first litter, especially from pullets, are generally smaller, and are not so likely to be fertile as those from later litters. To insure fertility of the eggs destined for hatching purposes the fowls should have all the exercise possible, plenty of green food, and the males should run with the flock at least a week before the eggs are used for setting. Care should also be taken not to overdo or underdo the rooster business. For the Plymouth Rocks, Dominiques, Wyandottes, and the non-sitting breeds, one vigorous cock to every fifteen or twenty hens when the fowls have free range; but when confined to yards the number of

hens allowed to each cock should be reduced by about one-third. For the Asiatic breeds, allow one cock to every twelve or fifteen hens when on free range; one to every ten or twelve hens when confined to yards.

Choose the largest and best-shaped eggs for incubation; but you need pay no attention to long eggs, round eggs, or wrinkled eggs, with the idea that by so doing you can control the sex of the chicks. There is no known way by which the sex of the egg can be determined previous to hatching.

To keep eggs for hatching, put them in a cool place and turn carefully every day or two.

Nests and Sitting Hens.—Sitting hens should always be where they can not be disturbed by the other fowls. When there is no separate room for the sitting hens in the poultry-house they should be removed to another building. Given an industrious hen and fertile eggs the chances of chicks depend greatly upon the nest. If the poultry-house or building used for the sitting hens has a board floor, be sure there are no cracks under the nests where the wind can come through and chill the eggs. If the floor is all right and covered as it should be with several inches of dry earth, and you use the bottomless nest boxes, all you have to do is to see the box in place, hollow out the earth a little in the middle of the nest, and put in plenty of fine hay or broken straw. In extreme cold weather line the nest with feathers. As a precaution against lice sprinkle sulphur, snuff, carbolic powder, insect powder, or fine cut tobacco in the nest; or, better still, use tobacco leaves or stems mixed with the nesting. If there is no earth on the floor of the place used for the sitting hens, one must do the next best thing—put a bottom on the nest boxes, and put in a sod or a few inches of earth under the nesting. If the nest box has been used for the laying hens, scald it out with hot suds, or whitewash it inside and out before using it for a sitting hen. Do n't use coal-oil about the nests of sitting hens; the fumes are so powerful and penetrating that they are liable to destroy the germ of life contained within the egg.

In regard to setting the hens and caring for them during the

period of incubation, I append the following directions that I wrote for the *Prairie Farmer* a few years ago: Set your hens at night, always. If you have any doubts about the reliability of your hen, give her two or three nest-eggs to practice upon until she settles down to business. If you want to set your hen in a strange place, have your nest ready, get your hen after dark, avoid frightening her, place her carefully on the nest, fasten a board over the front of the nest, leaving only a crack for ventilation, and do not remove the board until after dark the next night. In nine cases out of ten the hen will come off in the morning, eat her breakfast, and go back to her nest; but you must be on the lookout for her soon after daylight, and if she does not go back to her nest, put her back gently, and fasten her in for another day. Keep corn, water, gravel and charcoal, and a dust box where your sitting hens can help themselves. After the eggs have been set on a few days those that have been impregnated can readily be detected by testing them with an egg-tester. If the eggs are white-shelled they can be assorted by the fourth day, but with dark-shelled eggs it is better to wait until the eighth day.

The advantage to be derived from assorting eggs during incubation are obvious. If three or four hens are set at the same time, it quite frequently happens that after the non-fertile eggs have been taken from the nest two of the hens can accommodate all the eggs that contain a living germ, and in that case the other hens can be set again with a fresh lot of eggs. In the earlier part of the season, when setting hens are scarce, I find this a great advantage. The clear eggs, if taken from the nest before the ninth day, can be boiled and used for chicken food.

Should any of the eggs get broken in the nest, wash the remaining eggs in warm water, and clean out the nest, for an egg that is daubed with the contents of another egg will not hatch. During the last week of incubation the eggs should be sprinkled every other day with warm water.

Egg Testers can be bought at prices ranging from thirty cents up to two dollars, but for all practical purposes the tester

that we use, and which cost nothing except a little time and a few nails, is just as good as any. It is simply a wooden box large enough to hold a small kerosene lamp. There is a round hole in the top as large as the top of the lamp chimney, and in one side, high enough to come just opposite the flame, there is an egg-shaped opening. The opposite side is hinged with leather straps so that it can be used as a door to admit the lamp. Place the lamp in the box, close the door, partially darken the room, and hold the eggs, one at a time, between the thumb and forefinger, between the eye and the egg-shaped opening.

A barren or non-fertile egg looks light and nearly clear when viewed through the egg tester. A fertile egg will, at the fourth or fifth day, show a small dark spot, with tiny veins radiating from it. In the live embryo the veins will be distinct; in the dead one they will appear broken and cloudy. The eggs that contain dead embryos should be removed, as they will soon rot and become very offensive. From the fifteenth day onward the eggs which contain living chicks look dark, except the space occupied by the air bubbles at the large end. When the air bubble occupies an unusually large amount of space, and is fairly on one side, the chick is generally dead, and the sooner it is out of the nest the better.

Artificial Incubation.—The ancient Egyptians hatched and raised chickens successfully by artificial means, but in our day and generation all such attempts have, until within the past few years, proved failures, or at best but partial successes. The first incubators offered to the public in this country were not practical enough to meet the wants of poultry raisers, but the demand for an incubator that would “beat the old hen” was so great that inventive genius was stimulated, and as a result there are at present some half a dozen different kinds of incubators that will—if the manufacturers’ directions are carefully and intelligently followed—hatch a larger per cent of the fertile eggs than the hens. These incubators are rapidly coming into use, and the time is not far distant when no poultry raiser who wishes to raise over two or three hundred early chicks will consider his outfit complete without one or more incubators.

Fig. 18 correctly represents one of the most popular of the standard, self-regulating incubators, called the "Eclipse."

The advantages to be derived from the use of a good incubator are many. In the first place, one can set a large number at any desired time without waiting for sitting hens, and this is a matter of prime importance to poultry raisers who desire to raise any considerable number of early broilers for market. Next, there is an actual saving of time and money—it requiring very

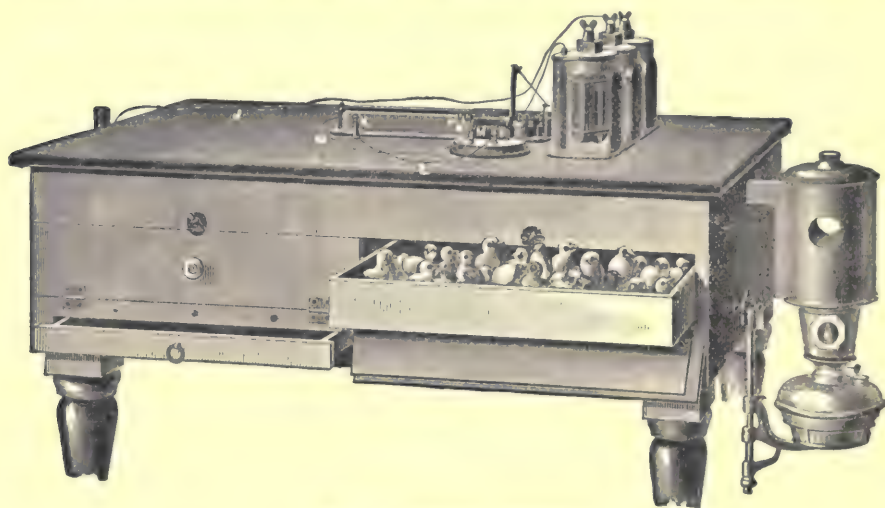


FIG. 18.—ECLIPSE INCUBATOR.

much less time to care for three hundred eggs in a self-regulating incubator than it would to care for the twenty-five or thirty sitting hens that would be required to hatch the same number of eggs the natural way; and the cost of running the incubator is more than balanced by the cost of food necessary for the number of hens that would be required to do the same amount of work. I would also call attention to the fact that incubator chicks are always free from lice to begin with, and incubators don't trample the life out of chicks before they get fairly out of the shell.

Incubator chicks that break the shell promptly on the twentieth, twenty-first, or even the twenty-second day (they will be out on time if the temperature has been kept right), are just as strong and healthy in every way, and—if properly cared for

after hatching—no more liable to die off “sudden like,” without any apparent cause than those hatched in the natural way.

Farmers who do not care to raise more than two or three hundred early chicks each season will not, generally speaking, unless they keep non-sitters exclusively, find incubators profitable; but those who desire to raise anywhere from three hundred to a thousand or more early chicks must, if they would get their chicks out early enough to command the best prices, use incubators.

Care of Young Chicks.—When the mother hen is quiet do not meddle at all while the chicks are coming out; but if she be restless and inclined to tramp around in the nest, remove the chicks as soon as dry, and keep in a warm place in the house until all are out; then place hen and chicks in the coop, which should be prepared beforehand for their reception. In cold weather these coops must be placed in a building or room that can be warmed artificially when necessary, and in order to economize space as much as possible each hen should be given from fifteen to twenty chicks.

Do not feed the chicks until they are from sixteen to twenty-four hours old. The yolk-sac, which is absorbed by the chick the last thing before it leaves the shell, is sufficient in the way of food until the chick is strong on its feet. The best food that chicks can have at first is undoubtedly the yolks of hard boiled eggs crumbled and mixed with stale bread crumbs that have been just moistened with milk. If eggs for chicken feed are scarce, use curds made by warming a pan of thick sour milk, and then draining off the whey. Cooked oat-meal and rice are also among the best kinds of food for young chicks, and should be added to the bill of fare after the first two or three days. The kinds of food mentioned are rather expensive for chicken feed, but as young chicks require but little at a time for the first week, they may be fed on such food for a week or so at very little expense. It pays to give chicks a good start, for those that are stunted to begin with will never make as nice broilers or be so good for any purpose as those that are fed generously from the start.

When two weeks old commence feeding cooked corn-meal, and cooked potatoes mixed with shorts. An excellent way to cook corn-meal for chicks is to wet it up with water or skim-milk, add a pinch of salt and soda, and bake an hour or more, according to the size of the loaf. Do not soak this corn-bread before feeding—except, perhaps, the outer crust—but just crumble up and feed as you would cracked corn or any other dry food.

When the boiled eggs and curds are dropped from the fare, feed a little meat each day. Boil the meat, chop fine and mix with the soft food. Bear in mind that a little meat goes a good way—a table-spoonful being sufficient to mix with a pint of feed. As soon as the chicks are old enough to swallow the grains, the last meal at night should be cracked corn, wheat, wheat screenings, and millet. All soft food should be seasoned slightly with salt, and occasionally a dash of pepper may be used. Twice a week powdered charcoal and ground bone—a table-spoonful of each to every pint of feed—may be given.

After the first few days give milk, sweet or sour, to drink. Other things being equal, the chicks that are fed on milk will grow right away from those that are deprived of it.

Chicks that are hatched in late winter or early spring, before the grass makes its appearance, must, after the first few days, have a daily supply of tender, green food. Lettuce, grass, and oats can be raised in shallow trays or boxes hung around the room where the chicks are kept, and clipped when a few inches high. Raw cabbage, sweet apples, onions, etc., may be chopped fine, and will be greatly relished by the chicks. Onions should not be fed within a week of killing. A supply of gravel must also be kept where the chicks can help themselves at all times. Lack of gravel is a fruitful source of indigestion among young chicks that are raised entirely within doors.

Feed often—nearly every two hours between daylight and dark for the first four weeks; after that time five times a day up to within twenty-four hours of killing for market. Some poultry raisers who raise large numbers of early chicks, make a practice of going around with a lantern and feeding as late as

between eight and nine in the evening. I think it pays, for in raising broilers the object is to get a given weight in the shortest possible time, and every thing that tends to that end should be done. Feed all the chicks will eat up clean each time, but no more. Never leave food around to be wasted, and never feed sour food or sloppy food. All food must be fresh and sweet, and soft food should only be moist enough to stick together.

The foregoing directions for the care and food of young chicks are intended more especially for those who only desire to hatch and raise a limited number of early chicks with hen mothers, and who have only the convenience of an ordinarily comfortable, well-lighted poultry-house that can be warmed by means of a common, air-tight, wood stove, or by a home-made brick stove; but they will answer equally well for the management of the later hatched chicks that are intended for the fall and winter market, and for breeding stock for the next season—except that, of course, the later hatched chick should have free range as soon as possible, when they will pick up their own green food and gravel, and obtain their own supply of meat in the shape of insects, etc. When allowed free range chicks will, after they are two or three months old, thrive on three meals a day until the time comes to fatten for the fall market.

After the chicks have been weaned they should be colonized and taught to roost in sheds like the one illustrated by Fig. 14. If very young when weaned they may be left in the nursing coops a few weeks longer.

How to Raise Incubator Chicks.—When one proposes to hatch and raise any considerable number of early chicks, wholly by artificial means, there will be needed—besides the incubator—artificial mothers or brooders, and a comfortable, roomy, well-lighted, well-warmed poultry-house. The first expense will necessarily be comparatively large, but after every thing is once in running order the annual outlay will be but trifling, while the business, if properly managed, will pay a large profit above all expenses, including interest on capital invested.

The best way to heat a poultry-house, where a large number of chicks are to be raised, is by means of a green-house boiler

and hot-water pipes. A boiler, pipes, etc., that will heat almost any poultry-house will cost, when set up ready for use, from seventy-five to one hundred dollars.

Artificial mothers are made of different sizes, and there are several different makes to choose from. The manufacturers of nearly all the standard incubators also manufacture or furnish plans for artificial mothers. When the chicken home is heated by hot-water pipes brooders can be made under the pipes at a trifling cost. "The essentials in an artificial brooder are: First, a provision for furnishing the proper heat above the chickens; second, a good method of ventilation; third, a perfect freedom from harboring places for vermin, and a simple arrangement by which the fleece or woolen lining may be readily removed and cleaned at any time." The shape of an artificial mother should be such that the chicks can not be crowded into corners and stifled. Avoid brooders with bottom heat. When the incubator chicks are hatching they should be taken from the tray soon after they are dry, and kept in a box or basket in a warm place for a few hours, when they may be placed under the artificial mothers.

Avoid overheating the brooders. Too much heat will cause the chicks to "wilt" and die off like newly-set cabbage plants under the hot sun. The body heat of the mother hen is ninety-eight degrees, and the temperature of the brooder, *when the chicks are under it*, should not go above that point.

Avoid crowding either in the house or under the brooders. Not more than fifty chicks should be put in one brood, and when three weeks old the number should be reduced to twenty-five. Separate the different broods by partitions of wire netting. The amount of floor-room required for a brood of fifty for the first three weeks will be about thirty-six square inches for each chick, or something like twelve or thirteen square feet for each brood. When three weeks old more space will be required, and only twenty-five chicks should be in each one of these small pens for the next three weeks. When six weeks old, move them to still larger pens, where each chick will have an allowance of at least one square foot of floor-room. In these pens they may be kept until sent to market. A little figuring

upon the above allowance of floor-room will enable any one to determine the size of a building required to accommodate any given number of chicks until they reach a marketable age, remembering that if one proposes to hatch, say two hundred and fifty chicks, every three weeks, space must be allowed for some seven hundred and fifty chicks in the building at one time, for the first lot will not be ready for market until after the third lot comes out.

The runs and the bottoms of the brooders must be covered with dry earth, sand, or gravel, which must be renewed often enough to keep clean; and every thing about the chicken-house must be kept clean. Neglect in this respect will cause the chicks to die off at an alarming rate.

Incubator chicks raised with artificial mothers require the same kind and quantity of food, drink, etc., as early chicks that are raised with hen mothers. As soon as the weather is warm enough, and sitting hens are plenty, incubator-hatched chickens may be raised out of doors with hen mothers. Fill the incubator with eggs and set a number of hens at the same time; when the chicks hatch those from the incubator can be divided among the hens—eighteen or twenty chicks to each hen.

Coops and Runs for Young Chicks.—Fig. 19 shows the style of coop that the writer has in use on her poultry farm, and it comes about as near perfection as any coop that we ever tried; at least we never heard the hens or chicks say a word against it. The upper half of the front is of wire netting which admits air and light, while the projecting roof keeps out sun and rain.

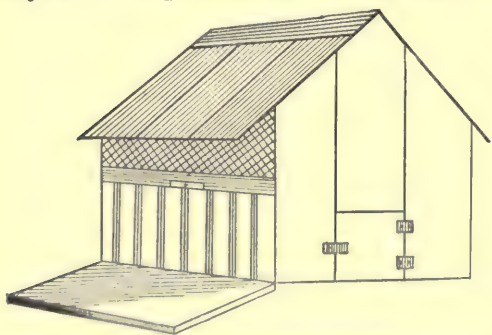


FIG. 19.—MODEL CHICKEN-COOP.

The lower half is made with perpendicular slats, and a door which turns up on hinges and fastens with a wooden button, making all snug and tight. When down this door makes an excellent place to feed the chicks. In one end there is a

small door for the hen, and when the coop is made with a floor the door will be necessary to enable one to clean the coop. Make the coop high enough so that the hen can stand upright without bumping her head against the roof, and large enough so that she can turn around without going out of doors.

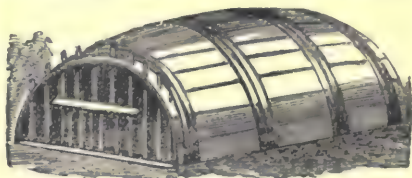


FIG. 20.—BARREL-COOP.

Fig. 20 is an illustration of a chicken-coop that any man or boy can make from a barrel, and a very good coop it is, too. Here are the directions for making: "Take an old barrel and tack every hoop on each side of a seam between the staves with an inch, wrought nail; after clinching the nails saw the hoops off on the seam. Then spread the barrel open, as shown in the illustration, by cutting a board about twenty inches long and fitting to the back end, and two small pieces to tack laths on for the front. Fasten the upper part of the back with leather hinges so that it can be opened at pleasure."

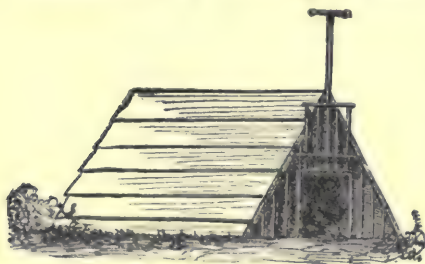


FIG. 21.—SIMPLE CHICKEN COOP.

make from the illustration. Fig. 22 shows a coop with door and floor, and is a good coop where rats are troublesome.

It is often necessary to confine the chicks as well as the hens; in that case safety coops and runs like those illustrated by Figs. 23, 24, and 25 will fill the bill. The runs may be covered with the wire netting or plastering lath, but we prefer the netting, and use such runs in connection with the coop shown by Fig. 19.

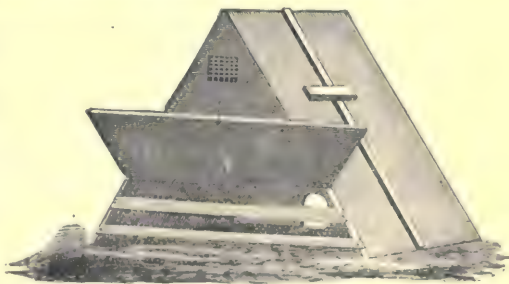


FIG. 22.—COOP WITH FLOOR.

In some localities the chicken or pigeon hawks are so numer-

ous and troublesome that it is almost impossible to raise chicks without the aid of these safety runs. Coops without floors are much the best for both hen and chicks, but when on account of

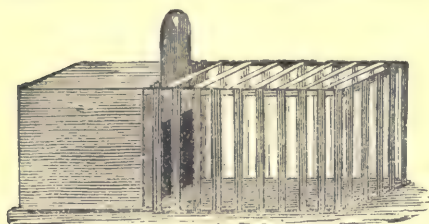


FIG. 23.—SAFETY-COOP.

the dampness of the ground, or because rats are troublesome, a floor is necessary, it should be covered with dry sand or gravel, which should be renewed every few days. When the coops have no floor they should be moved

to a fresh spot of ground twice or three times a week.

Coops and runs must be kept clean, dry, and free from lice. When a coop has once been used it should be whitewashed, or else thoroughly scrubbed with an old broom and hot suds, and when dry treated to a dose of coal oil before another family occupies it. When

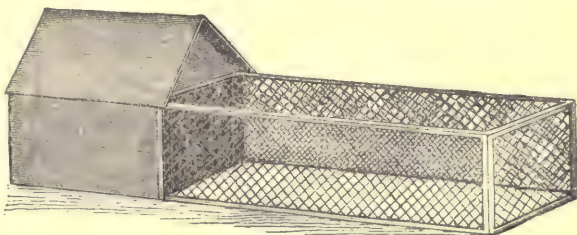


FIG. 24.—COOP WITH WIRE RUN.

through with the coops for the season, carefully clean them and put them under cover.

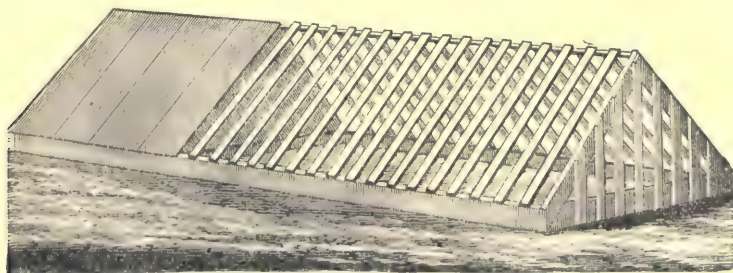


FIG. 25.—COOP WITH LATH RUN.

Feeding-pens.—When chicks run at large among older fowls it is desirable that they have a feeding place where they can eat without being robbed and driven away by the old fowls. For this purpose feeding-pens, something like the one shown by Fig. 26, will be very convenient. The directions for making are

as follows: "Get out fourteen strips one-inch thick, two inches wide, and six feet long; upon the edges of these strips nail plastering lath cut to half lengths (two feet), so as to make seven hurdles, each two feet wide by six feet long, nailing the lath two inches apart. Set four of these hurdles together so as to form a square pen, nailing them together at the corners, and cover with the remaining hurdles. This makes a pen where the little chicks can be fed, and they will soon learn to run to it when called."

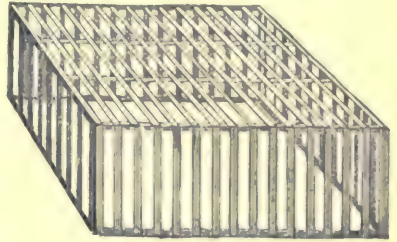


FIG. 26.—FEEDING-PEN

When, Where, and How to Market Spring Chickens.—Commence sending to market as soon as they are well feathered and will weigh from one and a half to two pounds, each, live weight. Sell where you can get the best prices, and you must find that place by watching the market reports of the places within your reach. If on a line of railroad, within reasonable distance of a city, try that market. A "reasonable distance" is one that is not so great that the cost of transportation will eat up all the profits. If near a large village where there is a demand for spring chickens, take a load and sell from house to house. We know one farmer who lives near a large manufacturing village who has built up quite a business in this manner. The first load was hard to get rid of, but he kept on going regularly, always selling good poultry, until at last he secured as many regular customers as he could supply. Village customers usually call for greater weight than city markets demand, and, of course, do not often pay New York prices; but still, at the prices obtained, there is a large margin for profit, and it sometimes happens that the poultry raiser can obtain better prices in a densely populated manufacturing or mining district than he could in any city market within his reach. In Western markets spring chickens are usually sold by the pair or dozen alive; in the East they are usually sold by weight, either alive or dressed, but the dressed are preferred, and bring much the best prices.

For shipping live chicks the coops should be light, strong, durable, and large enough so that the occupants can stand or sit without too much crowding. Folding coops are the best, because they occupy the least space when returned empty. A coop holding four dozen is a very convenient size, but do not crowd the four dozen all in together; it is better to divide the coop into two or four compartments. The bottom of the coop should be covered with dry sand. Have all the chickens in a coop as nearly of one size as possible. Do not put in a few inferior ones to "make out a dozen," thinking that the good chickens will sell the poorer ones; two or three undersized chickens in a dozen will often injure the sale of the whole lot. When the chicks are to be several hours on the road, feed and water the last thing before starting.

Fall and Winter Chickens.—Chicks that are hatched late in the fall and in early winter can, as soon as they will weigh from one and a half to two pounds each, dressed, be sold in New York and other large cities for winter broilers. They do not bring as high prices as spring broilers, but still the margin for profit is large enough to induce poultry raisers who can reach the large cities to engage in the business. Late in the winter and in early spring when these late fall chicks will dress from three to four pounds each, they are sold for roasters at prices considerable above those obtained for ordinary poultry.

Capons.—Caponizing or castrating young cockerels has been practiced in different countries for many centuries. The object is to increase the weight of the fowl and improve the quality of the flesh. Cockerels that have been caponized will at maturity weigh fully one-third more than the ordinary male fowl of the same age and breed; the flesh is finer grained, tenderer, and more juicy, and they will bring prices from thirty to fifty per cent higher than common poultry.

Caponizing is not, as many seem to think, a difficult operation; any grown person of ordinary intelligence can soon learn to caponize quickly and successfully. The following directions, originally published in the *Prairie Farmer*, are plain enough for any body: "In the first place, examine carefully the fowls that

you kill for the table, so that you may be able to tell the exact position of the organs to be removed. You will find them in the abdominal cavity attached to the back, one on each side of the spine; they are light colored and shaped something like a Lima bean. The size varies with the age and breed.

“Next, kill some young cockerels and practice on them until you are sure that you can perform the operation quickly and successfully; then you may try your hand on the living chickens. Select young cockerels that are fully three months and not over four months old, but some who caponize operate successfully upon cockerels that are five or six months old. Keep them from food for twenty-four hours previous to the operation; if the intestines are full the operation will be more difficult. Draw the wings gently backward and secure by a broad strip of soft cloth, lay the fowl on the left side, draw the legs backward and secure by another strip of cloth. From the spot near the hip joint, and between the last two ribs, pick off the feathers for the space of an inch square. With a small, sharp knife make a cut an inch and a half long through the skin, then another through the flesh between the ribs, and lastly through the thin membrane that lines the abdominal cavity—taking care in the last cut not to injure the intestines, and see that you make a clean cut every time. Now introduce the fore-finger, which should be well oiled, find the testicles, scratch them off with the finger nail, and bring them out with the finger. If you have practiced enough on the dead chickens you can do this quickly and readily; and if you have not practiced enough on the dead fowls you have no business to attempt the operation on the living ones. This part of the operation over, bring the edges of the cut together, take two or three stitches, and press the feathers that were removed upon the cut to absorb the blood and cover the wound. Feed sparingly for a few days. Of course some of the chickens will die, but unless you bungle your work the loss will be trifling.

“Instead of performing the chief part of the operation with the finger, as I have directed, some use the caponizing instruments that are made especially for the purpose; but I can do

just as well, if not better, with no instruments except a sharp knife, my finger-nail, a needle and some white sewing silk. For greater convenience the needle should be a curved one." A set of caponizing instruments consists of a pointed hook, a steel splint with a broad flat hook at each end, a pair of tweezers, and a pair of crooked concave forceps. Full directions for using accompany each set. Outside our largest cities there is at present no market for capons, but as the fine quality of this class of poultry becomes more generally known the demand will doubtless increase.

Turkeys.—Most farmers who undertake to raise a brood or so of turkeys do so with a feeling of uncertainty as to the ultimate result. Still it is not a difficult matter to raise turkeys, provided one knows how; and turkey raising is certainly a very profitable branch of the poultry business. I have never seen the time when good, fat turkeys would not bring remunerative prices.

The first step to be taken towards success in turkey raising is to secure good breeding stock. The parent birds must be strong, healthy, of good size, and mature specimens. No greater mistake could be made than that of buying inferior breeding stock just because it can be obtained for less than the price asked for good, mature birds. When possible to avoid it, do not breed from a yearling gobbler; but when no other can be obtained, select one of the earliest and largest of last season's hatch. Hens that are two years' old and over are better for breeders than those that are younger.

In regard to the "best breed"—for that question is sure to come up as soon as one mentions chickens, ducks, geese, or turkeys—there is really not much choice, except in size. The standard recognizes six different breeds—Bronze, White, Black, Buff, Slate, and Narraganset; and then there is the old-fashioned mongrel variety, which is n't such a bad variety, after all; but on account of the inferior size of the mongrels they are not so profitable to raise for market as some of the larger breeds.

Bronze turkeys are the largest and handsomest of the whole

turkey tribe. The illustration on this page is intended to represent a Bronze turkey cock, but no cut can do justice to their beauty. The main color of the plumage is, as the name indi-



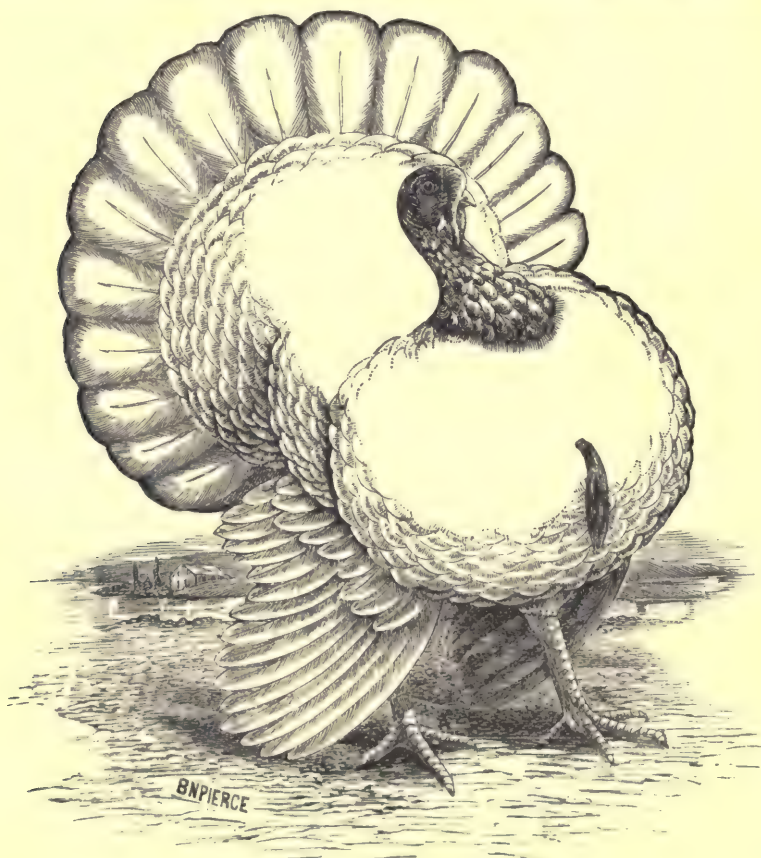
BRONZE TURKEY.

cates, bronze—dark in the shade, but when viewed in the sunlight each feather glistens like burnished gold. On account of their great size Bronze turkeys are great favorites with those who raise turkeys for market; well-grown males of this breed will weigh from eighteen to twenty-two pounds, alive, at six months, and the females from ten to fourteen pounds at the same age. Mature gobblers will weigh from thirty to forty pounds; hens from eighteen to twenty-two pounds. They do not reach maturity until the third year.

The White Holland ranks next to the Bronze in size, and is an excellent variety to raise for market. It is rapidly growing in favor with market poultry raisers. Our cut on this page shows a cock of this breed.

The Narragansetts are very popular among the farmers of southern New England, where great numbers are annually raised for market. Their plumage is a rich metallic black, each feather ending in a broad, light steel-gray band edged with black.

The other varieties are all good, but not so large as the three



WHITE HOLLAND TURKEY.

named. Farmers who have only common stock can, by mating the hens with a gobbler of any of the larger varieties, produce good market birds.

The breeding stock secured and mated (one gobbler to every ten or dozen hens), which should be by the middle of January at latest, feed sparingly from that time until March. I don't mean starve them, but only give food enough to keep them in "good working order." Fat turkeys will not lay so well as those that are thinner in flesh. Give green food and meat of some kind as often as four times a week after the first of February, and the hens will commence laying quite as early as it is desirable to have them.

It is natural for turkeys to hide their nests, and while I believe in humoring their whims in that respect, I do not believe that it is necessary to allow them to wander a mile from the farm buildings and deposit their eggs where no living thing—except, perhaps, crows and foxes—can find them. Long experience with turkeys has convinced me that it is possible to induce them to lay pretty much where one wants them to. By much petting of our turkeys, and by never allowing them to be frightened and driven about by either man or beast, we have made them so tame that they will generally go into the hen-house and lay in nests like any other sensible biddies; but all this takes time and patience, and the average poultry raiser had better fix up nests in secluded places, not too near or too far from the farm buildings. Do n't make "nice" nests; turkeys have a prejudice against "nice" nests that are prepared especially for them. An old barrel turned on its side in some secluded fence-corner and partly covered with brush, brush thrown carelessly around an old stump, and other such arrangements, suit turkeys; and also delude them into the belief that they are hiding their nests.

If the eggs are not allowed to accumulate in the nest the turkey will lay from thirty to forty eggs before offering to sit. The eggs first laid should be set under hens. When the turkey has laid from fifteen to twenty eggs, and the danger of chilly nights is past, the eggs may be left in the nest as laid, and when the turkey gets ready she will go to work and hatch every one of them. If she concludes to sit before she has a nest full of eggs, fill it up with some of those that you have taken from her.

A good sized turkey will cover twenty eggs. It is a good plan to raise a few chickens with each brood, for when chickens and turkeys are raised together the turkeys are less inclined to wander when young, are tamer, and when weaned will learn to come home at night with their foster brothers and sisters. And besides, when turkeys and chickens are raised together the grown turkeys seldom fight chickens.

Don't set turkey eggs too early; as a general thing it is not advisable to have them hatch before the grass is well started. When the turkey hen sits in her own nest out of doors, let her alone. Some turkey-raisers recommend taking the sitting turkey from her nest every day for feed and water, but we don't believe in it. Turkeys are close sitters, but they are not bent on starving themselves to death, and if left to act their own pleasure they will usually come off every other day, and if they are reasonably tame they will come around the buildings for food. When possible set two or three turkeys at one time; then, when they hatch, give all the young to one hen and the others will lay again. These late hatched turkeys will make fine birds for the late winter market.

When the turkey eggs are set under hens follow the same directions that have already been given for preparing nests for sitting hens. Unless the nest is on the ground, the sprinkling of the eggs during the last three weeks of incubation must be carefully attended to.

When the young turkeys are first hatched let them severely alone for the first twenty-four hours; they do not need food before the expiration of that time, and as they are delicate at first handling injures them; in fact, a good many are killed outright by much handling while they are very young. When they are twenty-four hours old the turkeys will be quite strong on their feet, and with the mother should be removed to a coop which should be clean and dry and have a board floor covered with sand or gravel.

The first food for young turkeys should be the same as for young chickens—hard boiled eggs, curds, and stale bread crumbs moistened with milk, and for the first two weeks feed nothing

else. The third week commence feeding cooked corn meal. Do not give a full feed of meal at first, but add a little more each day until at four or five weeks they may be fed entirely on corn-meal, cooked potatoes, and about any cooked food that one would give to chickens of the same age. A very little cooked meat may be mixed with the food once each day until they are big enough to forage for fresh meat; but when plenty of sour milk can be had the meat is not necessary. Onion tops and lettuce chopped fine and mixed with the food is greatly relished by young turkeys, and is very beneficial during the first few weeks. Never feed any raw meal to young turkeys; it should always be cooked for the first ten or twelve weeks. Feeding young turkeys raw meal, feeding meal too soon, and feeding grain before they are able to digest it will kill about one-half of the number hatched.

Feed young turkeys often, five or six times a day, until they are three months old. If you expect fine large birds for Thanksgiving you must keep them growing right straight along; full feed for the first three months will make a decided difference in the weight of the bird when market day comes. When they are three months old feed cracked corn, wheat, oats, wheat screenings, etc., but no whole corn until cold weather. After the third month turkeys will, if insect food be abundant, pick up a good deal of their living, and as long as the insects hold out they will thrive on two meals a day.

Young turkeys must be kept dry and comfortable during the first ten or twelve weeks of their lives, or until they are fully feathered and have thrown out the red on their heads. Exposure to cold and wet, tramping about in the grass before the dew is off, and damp, filthy coops will thin out a flock of young turkeys with alarming rapidity. To keep the young turkeys out of the wet grass use the safety coops and runs like the one illustrated by Fig. 23, or else make a pen in front of the coop by placing wide boards on edge and fastening in position. The boards should be from fifteen to eighteen inches wide, and for a dozen young turkeys the pen should inclose some fifteen square feet. For a few days after the poults are hatched, whether you

raise them with a hen mother or a turkey mother, they must be confined to this coop and pen; then, if all appear strong and well, and the weather favorable, open the pen and give the young liberty after the sun has completely dried the dew off the grass.

Should a sudden shower come up while your young turkeys are out in the field, you must turn out and drive them to the coops. If any are chilled, take them to the house, dry and warm them thoroughly, give them a good feed with plenty of ginger or red pepper in it, and then return to the mother hen.

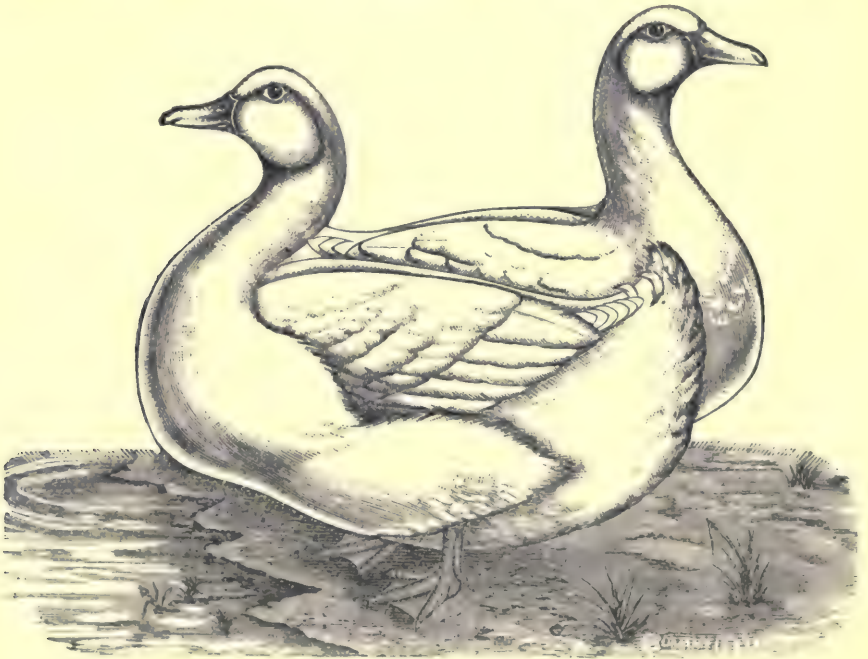
A good way to revive chilled turkeys is to dip them, all except the heads, in quite warm water, and hold them there until they show signs of life; then wrap them up, and keep in a warm place in the house until thoroughly warm and dry.

See that your turkeys come home every night. A hen mother will bring her brood home at night-fall, but for the first few nights the turkey mother must be hunted up and driven home, else she will squat down wherever night happens to overtake her, and get up in the morning and drag her brood around through the wet grass long before you think of getting out of bed. After you have driven her home a few nights she will probably come without any urging, especially if you always give her a good meal after she gets into the pen.

After they are fully feathered and have thrown out the red on their heads, which usually occurs at about three months, young turkeys are quite hardy, and may be allowed unlimited range at all times.

To fatten turkeys, give them their accustomed range and all the cooked corn-meal and potatoes they will eat up clean twice a day, plenty of grain at night, and milk to drink at all times. Mix a little pulverized charcoal in the food once a day. Three weeks of this feeding, and your turkeys will be in the best possible condition for the table; that is, if they have been kept growing and in good condition from the start. Remember that no amount of stuffing for a few weeks, just before killing, will make a prime, extra-large, table or market bird out of a turkey that has been starved and stunted from the beginning.

Ducks may be profitably kept on any farm that has a pond, swamp, or stream of running water within its limits, and is within reach of a city market; but the farmer who has not the advantage of a city market can hardly make it pay to keep ducks, unless he wants the eggs, meat, and feathers for home use, or can sell eggs for fancy prices. In large cities ducks' eggs will bring extra prices just before Easter; but at country stores "an egg is an egg," and ducks' eggs that weigh from three to three and one-half ounces each will bring no more per

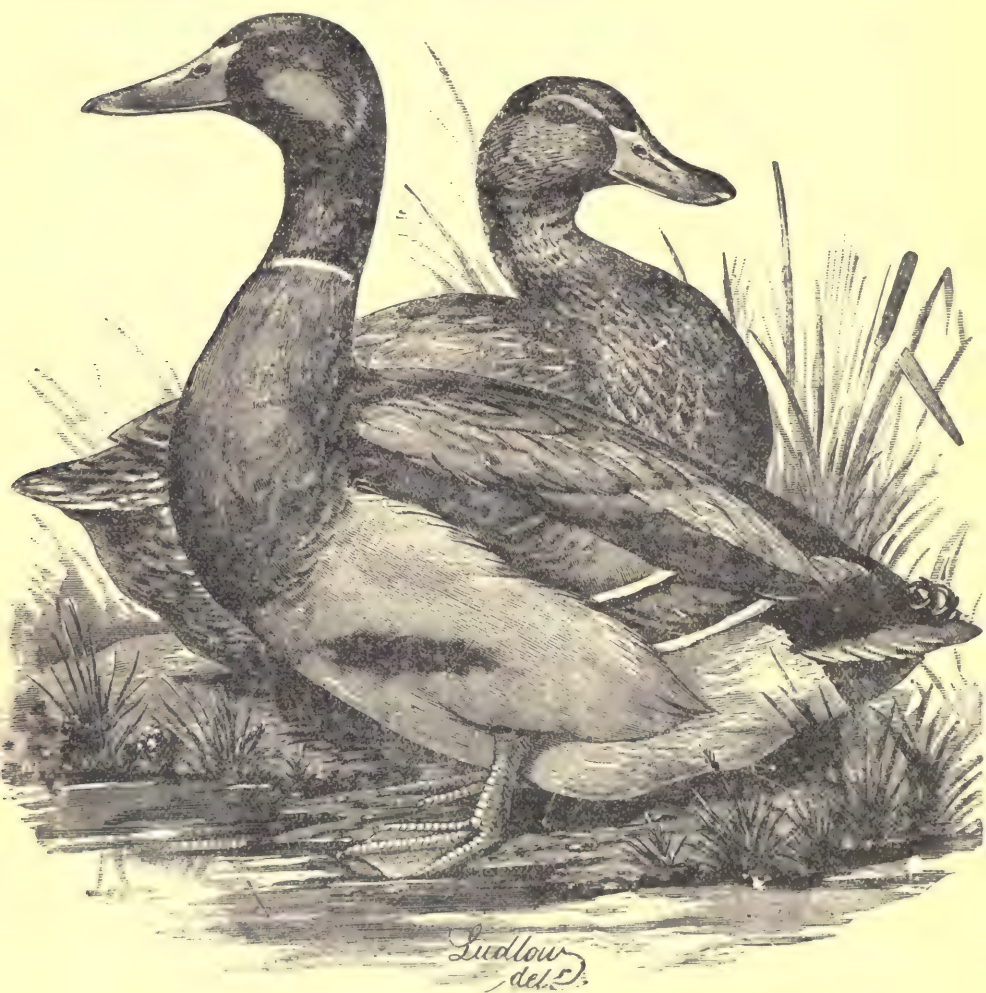


PEKIN DUCKS.

dozen than hens' eggs that weigh two ounces each. City dealers will pay from twenty-five to thirty-five cents per pound for prime live duck feathers, country merchants and peddlers about one-third as much. Prime young ducks will command paying prices in most city markets; in remote country places it is difficult to sell them at any price.

Ducks can be raised with only plenty of water to drink; but, after all, they are water fowls, and do best when they have access to a pond or stream, for, aside from the enjoyment that

they doubtless derive from paddling about in the water, they pick up a great deal of food about such places, and it is the very kind of food that suits them best.



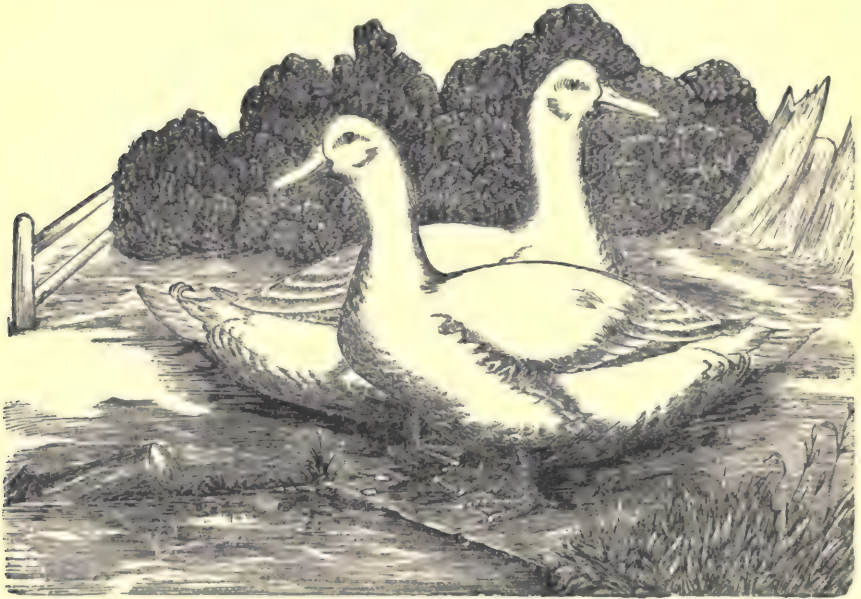
ROUEN DUCKS.

The Pekins, Rouens, and Aylesburys are the leading varieties of ducks.

The Pekins (see illustration, page 1103) are pure white, or creamy white, with yellow bills and orange-colored legs and feet. They are easy to raise, hardy, great layers of large, pure, white eggs, and excellent market birds. Full-grown Pekins

will weigh, when fattened for market, from sixteen to twenty pounds a pair.

The Rouens (see illustration, page 1104) are marked almost exactly like the wild Mallards; in fact, they are the wild Mallards domesticated and improved. In size and useful qualities they rank next to the Pekins.



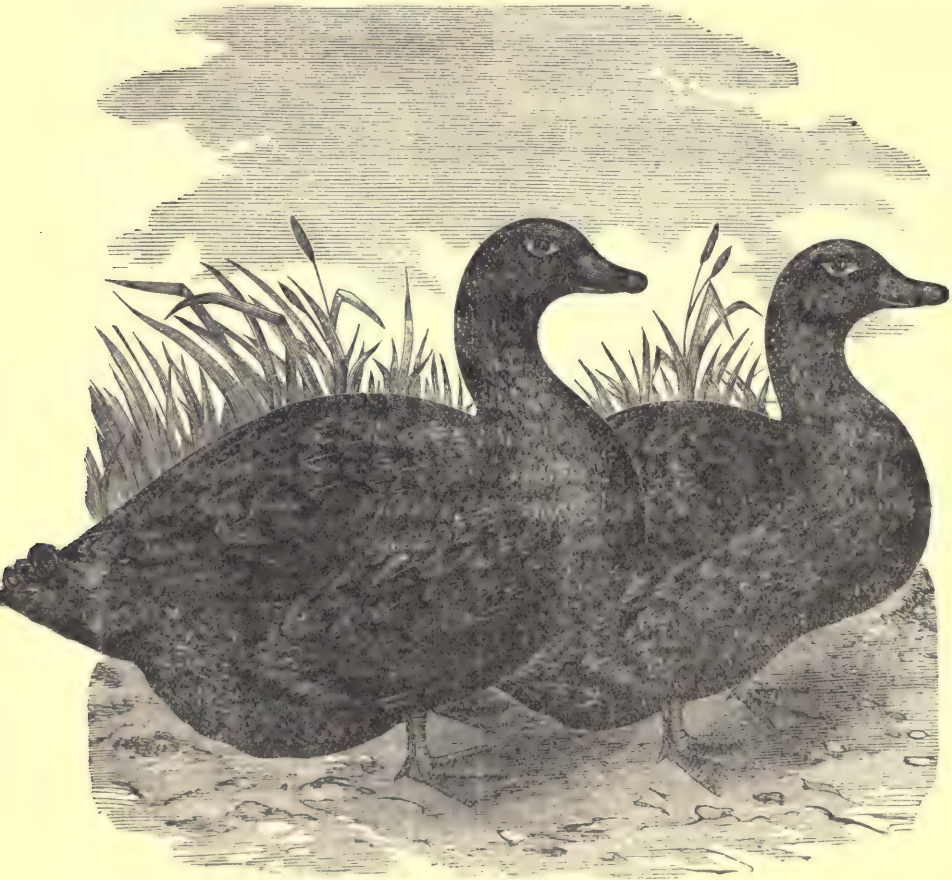
AYLESBURY DUCKS.

The Aylesburys (see illustration, this page) do not often grow so large as the Pekins, but in other respects they rank about the same.

Concerning the Black Cayugas (see illustration, page 1106), a variety not so well known as those already mentioned, the "Complete Poultry Book" has the following:

"This fine breed is American, and is supposed to have originated in the neighborhood of Cayuga Lake, New York, by a cross between the wild black, or Buenos Ayres duck, and the wild Mallard. The markings of the Cayuga duck are black throughout, except a narrow white collar around the neck, and white flecks on the breast, which latter tend to increase with age, and are avoided by breeders as much as possible. Both ducks and drakes show a greenish tinge about the head.

"The Cayugas are very hardy ; nearly as large as the Rouens, good layers and easily fattened. They are very quiet in their habits, and a fence a foot high will turn them. They are good sitters but careless mothers, hens being for these as for other ducklings, the best mothers."



BLACK CAYUGA DUCKS.

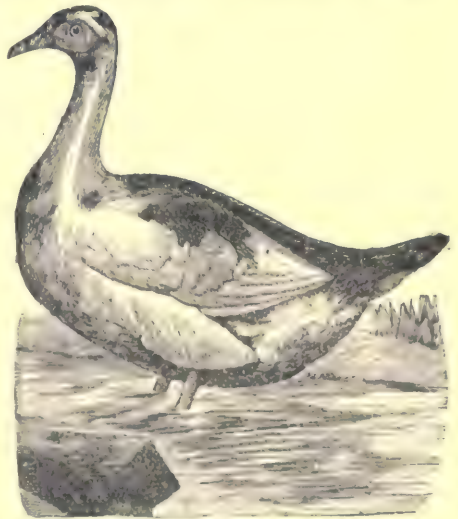
There are two varieties of Muscovy ducks—the White and the Colored. The Colored (see illustration, page 1107,) are Black mixed with white. Young Muscovy ducks are excellent table birds, but their flesh is not so desirable as they grow older. Drakes of this variety are quarrelsome, and can not be kept with chickens and turkeys. Muscovies are great flyers, and

can not be fenced in like the Pekins, Rouens, and Cayugas. Muscovy drakes weigh from ten to eleven pounds; ducks from five to seven.



COLORED MUSCOVY DRAKE.

A flock of ducks around the door-yard or the barn-yard is an unmitigated nuisance, and for that reason a piece of land around the stream or pond should be set apart for their use, and they should be confined to its limits. Where the fence crosses a stream, put in water gates. It is said that ducks will endure the severe weather of our coldest winters without shelter, but it certainly is not good economy to keep them that way, and the fact that they always seek shelter during driving storms of sleet and snow and in extreme cold weather convinces me that they need it. Upon our farm there is a long, low building a few rods from the water, and I find that in winter



COLORED MUSCOVY DUCK.

and during the cold rains of early spring and late fall the ducks spend a good deal of the time there. This building or shed is but five feet high in front, and slopes down to within a foot of the ground at the back. It was built of refuse lumber; has a board roof; three windows, each containing six panes of seven by nine glass in the south side; no floor, but every fall a few loads of dry gravel are put in, which keeps it free from filth. Under each window there is an opening for the ducks, and along the rear there are nests.

Ducks are very much inclined to lay around anywhere, and a little management is necessary in order to secure the eggs. The best way is to shut them up at night during the laying season. Ducks always lay at night, or very early in the morning, so the eggs can be collected and the ducks fed and turned out by sunrise. In front of our duck-house there is a good-sized yard, and as they are always fed in that yard they come regularly at sundown for their supper, when they are shut in for the night.

A trough of water should always be kept in the pen or yard where the ducks are shut up at night, unless the weather is freezing cold, and in that case they should be supplied with drink when given their supper. Ducks are often killed by giving them a hearty supper without drink, and then shutting them up all night where they can not get at water, and when not killed outright there is no doubt but that they suffer greatly from thirst.

Ducks generally make poor mothers, and as they lay a long time before offering to sit, it is necessary to set the eggs under hens. The directions that have been given for the management of turkey's eggs during incubation will answer equally well for duck's eggs. Duck's eggs usually hatch well. Ducklings should not be hatched too early; those hatched in April and May will grow to a good size for the early fall market, and those hatched later will make fine birds for the winter market.

Until they are fully feathered ducklings are as liable to die of chills and damp, caused by exposure to cold and wet, as young turkeys, and for this reason they must be kept out of the

dew and rain, and away from the ponds and streams until they are some six weeks old.

“As soon as the ducklings are well out of the shell, whether the mother be a hen or duck, coop them up in a coop with a pen like the one I have already described for turkeys. The ducklings can not climb over the sides of this pen, and should be confined to it for about a week. Water that has had the chill taken off may be supplied in shallow pans, and the ducklings will dabble around in it and enjoy it. Have your duck coops as far as convenient from the stream or pond, and they must be moved at least three times a week to fresh ground. After the ducklings are a week old, if they had a hen mother, the pen may be opened on pleasant days after the dew is off the grass, and the mother and her brood allowed liberty to wander around in search of food. By the time they are six weeks old their under feathers will be well out, and they may be allowed unlimited range.

“Ducklings are great eaters, and will eat almost any thing in the shape of food. Feed cooked food, with plenty of green food, until they are old enough to give free range. Almost any kind of food that you would give chicks and young turkeys is good for ducklings. Until they take to the pond or stream, unless insect forage is plenty, feed a little cooked meat. Feed often, but never give all they can possibly swallow; sometimes ducklings will eat until they kill themselves. After they take to the water the ducklings will pick up a large amount of the food that suits them best, and for this reason ducks are most economically raised in the neighborhood of ponds, streams, wet marshes, or near the sea.”

To get fine, large ducks, keep them growing from the beginning, and for three weeks before sending to market feed extra rations of cooked potatoes and corn-meal, with whole corn at night. Ducks that are to be kept over for breeding stock should be fed through the winter on grain, with an occasional meal of green food. Keep the best for breeding stock, and allow one drake for every three ducks.

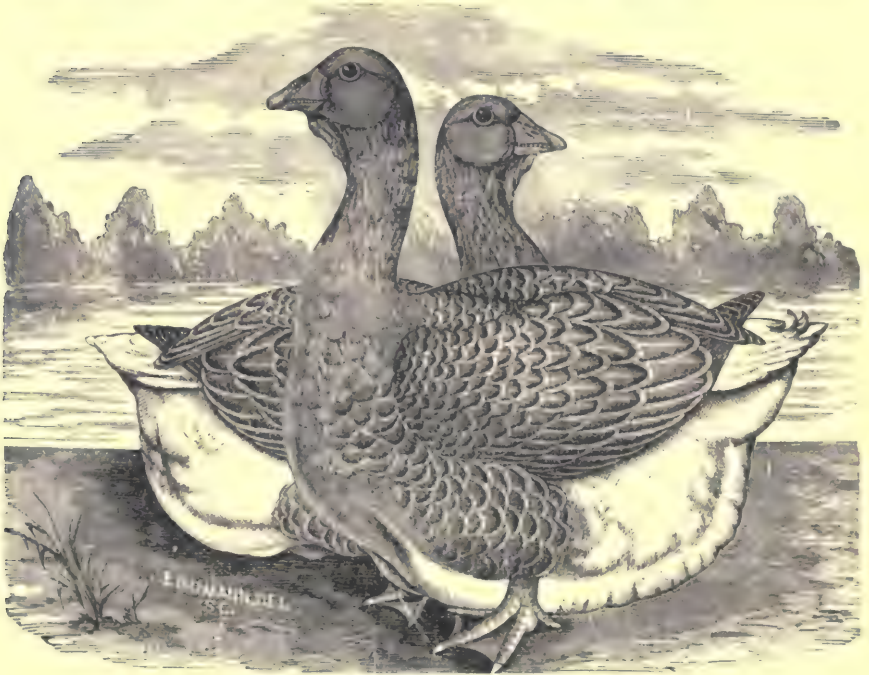
In regard to picking live ducks the following directions (from

the *Prairie Farmer*) will be found useful: "The proper time for picking ducks may be ascertained by catching two or three out of your flock and pulling out a few feathers here and there; if they pull hard and the quills are filled with bloody fluid, the feathers are not 'ripe,' and must be left awhile longer; but if they come out easily, and the quills are clear, the feathers are called 'ripe,' and the birds should be picked at once or they will lose the greater part of their feathers. To pick a duck before the feathers are fully ripe is to injure the fowl very much. You will find a bunch of long, rather coarse feathers under each wing; do not pluck them, they support the wings. When picking, take but few feathers at a time between the thumb and forefinger, and give a short, quick jerk downward; with a little practice you will soon get the 'knack' of picking easily and rapidly. Before commencing tie the duck's legs together, not with a cord that may cut into the flesh and lame the bird, but with a tolerably wide strip of cloth; and if the ducks are inclined to pinch with their bills, draw an old cotton stocking over the head; but with the exception of now and then a vicious old drake, our Pekins are as tame and peaceable as kittens, so we never bother ourselves or the ducks with the 'night-caps.' Handle laying ducks carefully, and sitting ducks and ducks that you intend to set soon should not be picked. When handling young ducks do not lift or carry them by the legs with the head hanging downwards; their bodies are heavy, bones tender and easily broken, or joints may be dislocated. In hot weather a great deal of the down may be taken from the drakes, but the down should never be taken in cold weather. Ducks can usually be picked from four to six times a year."

Geese.—No fowls can be so cheaply raised as geese, and farmers who have a pasture containing a pond or stream of water will find the rearing of geese very profitable. There is always a demand, and at good prices too, for live geese feathers, and prime geese, dressed or alive, will bring paying prices in any city market throughout the late fall, winter, and early spring months. In New York extra market geese can be sold nearly the year round. The leading varieties of thorough-bred

geese are the Toulouse, Embden, or Bremen, as they are sometimes called, and the China.

The Toulouse geese are the largest in the world, weighing, when fully matured at three years of age, from thirty to forty pounds a pair. Goslings of this variety will weigh from four to six pounds apiece when four weeks old. In color the Toulouse are dark gray on the back, shading off to light gray, and almost white on the under part of the body. They have fine feathers;

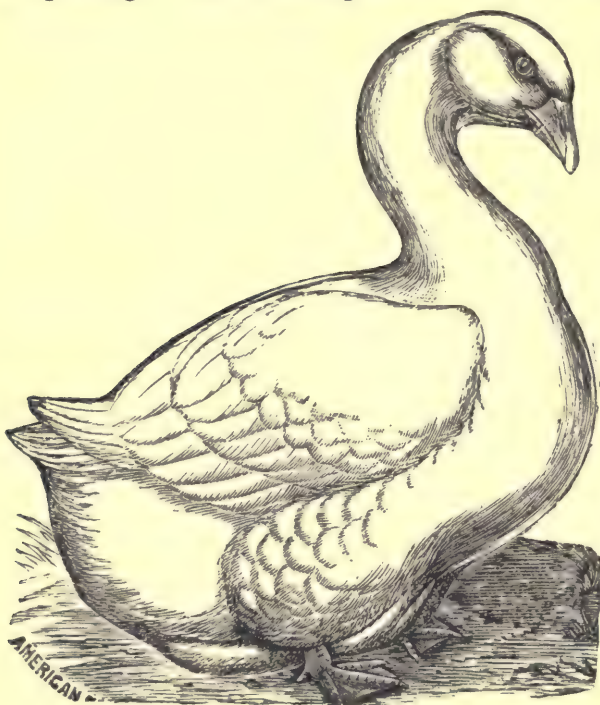


TOULOUSE GESE.

are not so noisy as common geese; goslings easy to raise, and are considered stronger than common goslings. On this page we give a fine illustration of a pair of Toulouse geese.

The Embden are not quite so large as the Toulouse, but many consider the flesh superior; and the pure white feathers will, in some markets, bring a higher price than those of colored geese. The Embdens are quite as hardy, and the goslings are as easy to raise as those of the Toulouse variety. The cut on page 1112 represents an Embden goose.

There are two varieties of the China geese—the Brown and the White—but they are really the same thing—except in color of plumage. The China geese are not so large as the Toulouse



EMBDEN GOOSE.

and the Embden, but they are better layers, while their reputation for early maturity, hardiness, and for quality of feathers is quite up to that of the larger breeds.

The very finest market geese are produced from a cross between the Toulouse and Embden. These cross-bred birds grow larger than either of the thorough-breeds, and

their flesh is remarkably fine. All the geese should be pure Embdens and the gander a pure Toulouse. These cross-bred geese should never be kept for future breeders for they produce young of inferior size and quality.

Three geese can be mated to one gander, and the same breeding stock kept for several years. Keep breeding geese thin in flesh, they will lay better and their eggs will hatch better than when kept on a full feed of grain. The best breeders turn out to pasture as soon as the snow is gone, and after the grass is well up feed nothing. After the geese are turned out to pasture they can get along without shelter, but it is a good plan to have a shed somewhere near the water.

Geese commence laying from the latter part of February to the middle of March, and lay from twenty to thirty eggs before

offering to sit. The time for hatching goslings is from the middle of April to June. The eggs should be set under hens, especially if you keep the Toulouse. The Embden and the China geese sit well and make good mothers. When set under hens goose eggs need the same care during incubation as duck and turkey eggs, but when geese sit let them alone.

When the goslings are out they must have a warm, dry coop, and like young ducks and turkeys they must be sheltered from storms and kept out of the dew for the first four or five weeks. Give goslings the same food recommended for ducklings. When five or six weeks old they may be turned out to pasture, and the rations gradually reduced to one meal a day. If on good pasture they will grow on grass alone after the first six or seven weeks; but if extra large geese are desired it will pay to give scalded meal or boiled turnips mixed with bran and meal, once a day.

Concerning the fattening of geese for market a writer in the *Poultry World* says:

“Geese may be fattened for market at two different periods of their lives, either at the age of six or eight weeks, when they are termed *green geese*, and are highly esteemed, or when they have attained their full growth. The method is very nearly the same, plenty of wholesome food and limited space for exercise, as the more quiet they remain the faster they will fatten. Since all geese are gregarious and sociable, if only a part of the flock are to be fattened they had best be fastened up where they will not see their accustomed companions, as, should they feel lonely, they are apt to sulk and refuse food.”

Most geese are sold in winter, and these should be fed (after the supply of grass is cut off by frost), with boiled corn, cooked potatoes, boiled oats and barley-meal, with rowen soaked in warm water and sprinkled with meal. Of course they must at all times have plenty of water to drink. The *Poultry World* writer, before quoted from, says that “care must be taken to seize just the right time for killing your fatted geese, as when they have reached a certain limit they begin to fall off.” Geese can be picked two or three times during the season, according to the

weather. Full-grown Toulouse geese will yield nearly half a pound of feathers at a picking. To pick geese, follow the directions for picking ducks, given on another page.

Preparing Poultry for Market.—The very best poultry will fail to bring the highest price if it be not dressed in good shape and put up in the style that customers demand. This is especially true of New York and New England markets. From the *Ohio Farmer* I copy the following directions for preparing poultry for the New York market. They were prepared from information furnished by leading New York commission merchants :

“Western poultry does not usually bring the highest price in the New York market, for the reason that it is generally inferior in quality, and put up in an unattractive shape. In order to sell well in New York, poultry must be of good quality, and put up in the style that that market demands.

“Fowls, old or young, that have been kept in good condition right along, will require about ten days of extra feeding in order to put them in prime condition for market. Separate the market birds from the rest of the flock, and feed liberally three times a day. For the first day or two do not give all the fowls will eat, but increase the quantity of food given each meal until they have as much as they will eat up clean. For the morning and noon feed give boiled potatoes, beets or carrots mixed into a stiff mass with corn and barley-meal; at night give whole corn. Keep gravel, charcoal, and plenty of pure water or milk in the coop. If skim-milk is plenty mix their food with it. For the last three or four days mix a handful of pulverized charcoal with each bucketful of soft feed.

“It is against the law to offer in the New York market dressed chickens or turkeys with full crops. The city ordinance reads as follows :

“‘SEC. 1. That no turkeys or chickens be offered for sale in the city unless the crops of such turkeys and chickens are free from food or other substance and shrunken close to their bodies. That all fowls exposed for sale in violation of this ordinance shall be seized and condemned; such of them as shall be tainted

shall, upon examination, be destroyed, and the rest which is fit for food shall be used in the public institutions of the city.

“‘SEC. 2. Every person exposing for sale any chicken or turkey in contravention of this ordinance shall be liable to a penalty of five dollars for each chicken or turkey so exposed for sale.

“‘SEC. 3. This ordinance shall take effect on the first day of October, 1882.’

“The city authorities claim that this ordinance will be strictly enforced, and shippers must keep all food from poultry at least twelve hours before killing, and it would be better not to feed for twenty-four hours previously.

“The reason for this is, that a mass of undigested or half digested food soon sours, becomes putrid, and taints the whole carcass.

“The fowls may be killed by opening the veins in the neck or by making an incision in the mouth at the back of the roof, which will cause almost immediate death. Suspend the fowls by the feet and make the cut with a narrow-bladed, very sharp knife. If one lacks spunk enough to kill fowls that way, or prefers cutting off the head, take it off ‘just back of the ears,’ and after the feathers are removed turn down the skin, cut off a piece of the neck bone, draw the skin back in place, tie and trim so as to present a neat appearance. But no matter how you kill the fowls they must be allowed to bleed freely in order to have the meat present a bright, healthy appearance.

“Most of the poultry sold in New York market is wet picked, and is generally preferred for the reason that a slightly inferior fowl looks better after scalding and ‘plumping’ than a dry-picked fowl of the same quality. It takes extra nice fowls to look well when dry-picked, but when dry-picked poultry is prime, it brings a higher price than the best scalded. Most of the prime dry-picked poultry that is sold in New York comes from Bucks County, Pennsylvania, is known as Philadelphia poultry, and brings extra prices.

“For scalding poultry have the water scalding hot, take the fowl by the head and legs and dip in and out of the water three

times. If the head is to be left on it must not be scalded, for that would injure the bright appearance of the comb, give the eyes a shrunken look which would convey the impression that the fowl was diseased when killed. Remove the feathers and pin-feathers without breaking the skin, and avoid bruising the flesh; bruised places and abrasions of the skin soon turn black and greatly injure the appearance of the fowl. Singe the fowl without smoking it, then dip for about two seconds into water that is almost boiling hot, and at once into cold water for the same length of time. This process is called 'plumping,' and will give a tolerably lean old hen an appearance of respectable fatness. The intestines and crop must not be drawn. If the feet and shanks are dirty wash them clean, also the comb and the feathers about the head.

"The poultry should be entirely cold, but not frozen, before it is packed; if packed before it is quite cold it is sure to spoil. Use boxes of medium size, those that will contain from one to two hundred pounds, and dry, *clean* straw for packing. Put a layer of straw in the bottom of the box, then a layer of poultry, backs upward, legs drawn backward under the body, wings folded snugly at the sides, and heads of the first row tucked under the body. In the next row pass the heads up between the rumps of the first row. The last row, turn the heads towards the end of the box as in the first row and pass the legs back under the others. Never double up the legs, and in placing the heads of the first and last rows be careful not to crowd so close to the bodies as to leave a discolored mark. Fill all spaces with straw, cover this layer with straw enough to keep from contact with the next one, and fill the whole box in the same way. Cover the top layer with straw enough to make the cover fit down pretty snug, for if the fowls shift about in the box it will injure the appearance, and consequently affect the sale. When the weather is very cold, use more straw around the top, bottom, and sides of the box, and wrap each fowl in clean, white paper. It is a good idea to wrap each fowl in the white paper, any way, whether necessary to keep from freezing or not; the fowls look neater, it will prevent discoloration where

the fowls come in contact with each other, and if there should happen to be a bit of dust in the straw, the paper will keep it from the fowls. Unprinted paper can be obtained at any printing office, and costs but a trifle.

“The poultry will sell better if it runs even through the package. When packing large lots, put the largest and best in one box, the medium size in another, and the smallest in the third. Don't think that by mixing a few large fowls in with the smaller ones that it will help the sale of the small ones; it will be more apt to spoil the sale of the whole lot. And if you have a lot of chickens that are really inferior, don't send at all; dispose of them for what you can get in your local market. Don't pack turkeys, ducks, geese, and chickens all in the same box; have a separate box for each kind.

“Mark the address of the commission house to which the goods are shipped plainly on the cover; also the kind of poultry and weight. Have your own name and address, or some particular mark or brand of your own on all packages, and if you ship first-class poultry your brand will soon be in demand. The marking should be done neatly, for the better your packages look on the outside the more favorably will they strike the eye of the buyers at the first view.

“When you ship your poultry send at once by mail a correct invoice of the shipment.”

For shipping wild turkeys, wild ducks, and smaller wild fowls, Messrs. Van Valkenburg & Ronk, New York, give the following advice: “Wild turkeys, wild ducks, and the smaller birds should be packed in the natural state. Prairie chickens, woodcock and quail, in cool weather, reach us in better order and sell more readily when wrapped in paper, the feathers being first laid smoothly in place. Grouse, when shot, should be *hung up by the feet*, so that all the blood may run out of the mouth. If the weather is very cold, so as to freeze at once, it is better to stroke the feathers down smoothly and hang up by the neck. All animal heat should be out of the birds before packing. Press firmly into the package; two hundred pounds may thus be packed into a common flour-barrel. The freight on

trapped birds is no more than others, and those shot or otherwise mutilated not only bring a low price, but are apt to spoil, and by their more rapid decomposition cause the others to smell badly, thus injuring those that they are packed with more than the value of the mutilated birds. If they must be sent send in separate packages. The number of dozen, pairs, or pieces, as the case may be, should be marked on the head of the barrel. Wild turkeys should be packed in boxes instead of barrels."

For New England markets poultry must always be drawn; in fact, it is against the law in Boston to offer undrawn poultry for sale, except spring chickens that weigh two pounds or less, and these must have empty crops. New Englanders also prefer dry-picked poultry. After dressing poultry, instead of laying on a board, shelf, or table to cool, tie the wings close to the body in a natural position, and then hang up by the feet. By this method there are no flattened portions, and the fowls look better and pack better. For tying the wings back use strip of cloth rather than strings, for the latter are apt to cut into the flesh and leave a mark. To pick domestic ducks and geese easily, scald as you would chickens, and then wrap for ten or fifteen minutes in a blanket or piece of an old quilt; this steaming, provided you happen to get the right scald, loosens the feathers and down so that all come off easily. The feathers should be saved and carefully dried.



CHAPTER XIX.

POULTRY DISEASES AND THEIR REMEDIES.

CAUSES.—The chief causes of disease among poultry are damp houses, swampy yards, lack of cleanliness about the houses and yards, impure water, improper food, overfeeding, lack of sufficient ventilation, crowding too many fowls into one house, lice, and lack of constitutional vigor in the parent stock.

Prevention.—It is easier to prevent poultry diseases than to cure them, and it is cheaper, too. The preventive measures here recommended are indorsed by all the leading poultry authorities in the country, and from practical experience and personal observation I can assure the reader that the poultry yards where the following directions are faithfully observed will not often be visited by disease of any kind.

1. The poultry-house should be dry, clean, thoroughly ventilated without exposing the fowls to draughts of air, and never over-crowded. Every morning some absorbent—dry earth or land plaster—should be sprinkled over the droppings beneath the roosts; and twice a week in summer, once a week in winter, the droppings should be removed from the house. When the floor of the house is covered with earth it should be frequently raked over, and twice a week fresh, dry earth should be put in. Every spring and fall, oftener when chicken cholera or any contagious disease is in the locality, whitewash the whole of the inside of the house. When disease is present among the flock, dissolve one-half pound of copperas in a pailful of hot water and use it to mix the wash with. When chicken cholera prevails in neighboring poultry yards use daily a disinfectant fluid made by dissolving three pounds of copperas in five gallons of water,

and then adding one-half pint of crude carbolic acid. Sprinkle about the inside of the house with a common watering-pot. This mixture should be kept corked in jugs.

2. The yards and other places where the fowls congregate should be well drained, and no decaying animal or vegetable matter, no stagnant water, no filth of any kind, allowed anywhere about the premises.

3. Keep fowls and chicks free from lice.

4. Never breed from unhealthy fowls, or from fowls that have recovered from a serious attack of roup. I do not know whether roup is hereditary or not; but I do know from experience and observation that chicks from fowls that have had the roup do not, generally speaking, seem as strong as chicks from fowls that have always been healthy. They are very apt to die off rapidly during the first spell of cold, damp weather that comes along after they are hatched; and if any survive until fall they are almost sure to take the roup then.

5. Feed only fresh, wholesome food; do not overfeed; give plenty of pure water or milk to drink; do not overstimulate with any of the so-called "egg-food;" and unless some contagious disease is present among the flock, or in the immediate neighborhood, do not dose the fowls with preventive medicines. For well fowls, except under the circumstances named, such medicines are worse than useless—they are positively injurious.

6. Have some building apart from the poultry-house that can be used when occasion requires as a hospital for sick fowls, and whenever a fowl exhibits symptoms of disease at once remove it to this building. When strange fowls are brought upon the premises it is a wise plan to keep them in this building, apart from the other fowls, until sure that they have no contagious disease lurking in their systems. When the hospital has been used for fowls afflicted with roup, canker, or cholera, it should be thoroughly disinfected before it is again used.

7. At any time, when the fowls mope around and eat but little, cut down the allowance of food; and once a day, or until the fowls appear all right again, give the "Douglass mixture" in the food or drink. The following is the

RECIPE FOR DOUGLASS MIXTURE.—Dissolve one pound of copperas in two gallons of soft water; then add one ounce of oil of vitriol. Keep corked in a jug. Dose, one tea-spoonful to a pint of drinking water. Concerning this “mixture,” Ward’s “Poulterer’s Guide” says: “This preparation, simple as it is, is one of the best tonics for poultry known. It is alterative as well as tonic, and possesses, besides, antiseptic properties which make it a remedy as well as a tonic.”

Care.—Since the utmost care and watchfulness on the part of the poultry-keeper can not always prevent disease from gaining a foothold in the poultry-yard, every one who keeps poultry should know something of the diseases to which fowls and chicks are most liable—be able to recognize the symptoms and decide what remedies to administer. A little timely knowledge and a few cents’ worth of medicine will often enable the poultry-keeper to save the life of a valuable fowl, and also prevent the spread of disease among the rest of the flock.

In preparing the following pages upon the treatment of poultry diseases, I have aimed to give in a condensed form all the information that will be of any practical use in the treatment of sick fowls. The remedies prescribed are the best yet discovered; but the poultry-keeper should bear in mind that in order to successfully combat any disease the cause which produced the disease must be first searched out and removed, and that medicine will not often work the hoped-for cure unless the fowls are treated in the very first stages of the disease.

Lice.—If lice on fowls do not actually cause disease they so weaken the vitality that the fowls fall easy victims to the first poultry disease that comes along; and quite frequently, when fowls mope around and appear about half sick, an examination will reveal the fact that lice are at the bottom of the mischief; hence, whenever fowls are ill, lice should be the first thing looked after, and, if found, a vigorous warfare of extermination should be waged.

For common chicken lice on adult fowls, and also for the spider lice, or red mites, as they are generally called, there are no better remedies than whitewash and sulphur smoke to kill

those about the poultry-house, and coal-oil for those on the fowls. Catch the fowls, and rub a little of the oil on their heads, under the wings, and into the feathers on the under-part of their bodies. Burn the old nesting, clean the nest-boxes with boiling soap-suds, and then apply coal-oil to the cracks. When the new nesting is put in use a little tobacco, sulphur, or carbolic powder in the nest.

Whitewash the whole of the inside of the house, taking care to get it well into the cracks; then shut up the house tight, carry in a pan of coals, throw on a half pound or so of sulphur and smoke out the lice that the whitewash and coal-oil do not reach. Keep the house filled with sulphur smoke for an hour or so, and then open and air before admitting the fowls. The roosting perches should be carried out of doors, scrubbed with an old broom and hot suds, and when dry wet with coal-oil. Some three or four days after this general cleaning up, treat the fowls and perches to another dose of coal-oil, and again fumigate the house; this will probably finish up all that escape the first onslaught. The red mites are harder to get rid of than the common chicken lice, but patience and plenty of whitewash, coal-oil, and sulphur fumes will finally clear them out.

After you have once cleaned the lice out, keep them out by supplying the fowls with a dust bath in which there is a mixture of dry unleached ashes, and occasionally drenching the perches with coal oil.

Lice on Chicks.—For the large lice that infest the heads of young chicks, anoint the head with sweet-oil and carbolic acid—one part of acid to one hundred of oil; or if this be not at hand, use whale-oil, bacon fat, or salted lard. As the chicks grow older, if they are troubled with lice, use the mixture of oil and carbolic acid under their wings and on the under part of their bodies; or dust the mother hen at dusk with carbolic powder, or with insect powder; the chicks will get their share from the feathers of the mother. Never use sulphur and lard, or sulphur and coal-oil on young chickens; it will generally kill lice and chickens together. Coal-oil may be used on chicks after they are three or four months old.

Chicken Cholera is one of the "germ" diseases, and these germs are undoubtedly generated by filth in some form or other. D. E. Salmon, D. V. M., veterinarian of the department of agriculture, says: "These germs under ordinary conditions must be taken into the stomach with the food or drink to produce their effects, and consequently, by a proper use of disinfectants, the disease may be almost entirely prevented. Fowls may also be made insusceptible to cholera by vaccination with a feeble virus, or by inoculation with a diluted virus. A few investigations to determine the best method of putting up the virus, and there is no doubt but that it could be sent to every part of the country in such form that any one could use it."

The usual symptoms of cholera are thus described by A. J. Hill in his "Treatise on Chicken Cholera:" "The fowl has a dejected, sleepy, and drooping appearance and does not plume itself, is very thirsty, has a slow, stalking gait, and gaps often. Sometimes the fowl staggers and falls down from great weakness. The comb and wattles lose their natural color, generally turning pale, but sometimes they are dark. There is diarrhoea with greenish discharge, or like sulphur and water; afterwards it becomes thin and frothy. Prostration comes on, the crop fills with mucus and wind, and at last the food is not digested, breathing is heavy and fast, the eyes close, and in a few hours the fowl dies."

Should your fowls commence to die off "kind o' sudden like," and you have any doubts about the nature of the disease, make an examination of the internal organs of the defunct fowls, and that will settle the matter. I have made a post-mortem examination of several fowls that died from cholera, and I always found the crop filled with wind and sour food; the gizzard sometimes contained sour, half digested food, and sometimes the contents seemed dried up; the intestines very much inflamed, and generally half filled with a greenish matter; blood very dark and thick; heart generally enlarged; liver always very much enlarged, in some cases twice its natural size, of a dark green color, sometimes almost black, full of blood, and so tender that it would fall to pieces from its own weight.

There is no known "sure cure" for chicken cholera—nothing that can be depended upon to cure all, or even a majority of the fowls affected. The best method of dealing with the disease when it appears is the heroic course of treatment, and it is substantially as follows: Kill all the sick fowls and bury them deep with a quantity of quick-lime. Follow these funeral rites with a general cleaning up and disinfecting of the whole premises. Whitewash the house and scatter lime freely about the yards. Wherever the sick fowls have left their droppings, wet the earth freely with the disinfecting fluid recommended on another page. Turn the fowls out of the house, shut it up as close as possible, put a pound of sulphur in an iron kettle, pour on a half pint of alcohol, set it inside the house where you can reach it from the door, hold your nose with one hand, set fire to the alcohol with the other, shut the door and run. The burning sulphur and alcohol will send off sulphurous acid gas that will kill every thing that has life, cholera germs included. After this fumigation use the disinfecting fluid daily about the house, and all places that the fowls are in the habit of frequenting until after the last trace of the disease has disappeared.

Give the apparently well fowls something to kill the germs that may have been taken into their systems, and for this purpose there is nothing better than a solution of carbolic acid and water. Sixty drops of water to one of acid forms a solution; give each fowl three or four drops of this solution daily for a week; or, instead of giving it that way, add four or five drops of the acid to a quart of water, and use it to mix their morning food with. Give plenty of willow charcoal, or if that be not at hand feed charred corn once a day. In nine cases out of ten this method will, if the work be thoroughly done, stamp out the disease at the very outset, and with the loss of but few fowls. In the tenth case keep right on with the killing, disinfecting, and use of preventives; it will finally conquer.

For the benefit of those who may think it best to doctor the sick fowls, I have selected the following as the best of a long list of cholera cures. They are highly recommended, and will without doubt effect some cures, provided the disease is in a

mild form and the medicine is administered in the very first stages. With all these remedies, except No. 4, give the Douglass mixture freely—a table-spoonful to a pint of water—in the drink; but do not allow the fowls to drink much at a time.

1. Two drachms of calomel mixed with one quart of corn-meal; feed twice a day.

2. Calomel and blue mass in two grain doses, or four grains of blue mass mixed with two grains each of gum camphor and cayenne pepper; give twice a day.

3. Powdered chalk, powdered charcoal, gum camphor, assa-foetida, and pure carbolic acid, equal parts; mix all together and feed in the proportion of one tea-spoonful to every ten fowls. Give in soft food twice a day.

4. Fowler's solution, one ounce; aqua ammonia, half an ounce; water, one gallon; mix. Give this to the fowl to drink in moderate quantity three times a day. Allow no other drink.

5. Hyposulphite of soda; half a level tea-spoonful, in as much water as will dissolve it, is a dose for a grown fowl. Give once a day for three days.

Roup is the most troublesome, offensive, and, with the single exception of cholera, the most fatal disease that the poultry raiser has to fight against. In his book on poultry diseases, H. H. Stoddard says: "Roup is a disease of the lining membrane of the beak, extending, however, to the whole head and throat, through the tear duct to the eye, and finally affecting the whole constitution. In fatal cases death ensues in three to eight days after the specific roup symptoms show themselves, and cases not treated are generally fatal whenever the malady appears as an epidemic in its severe form. There are many other names under which this malady is often described—swelled eyes, diphtheria, sore head, hoarseness, bronchitis, asthma, snuffles, canker, blindness, influenza, sore throat, quinsy, etc.—but some of these conditions may exist even when roup is not present."

Roup never comes without a cause, and the cause generally comes from neglected colds among fowls that are kept in damp, sunless, filthy, ill-ventilated houses. Fowls take cold from undue exposure to cold and wet, roosting in draughts and in damp

houses, and from the sudden change from the warmth of artificially heated poultry-houses to the cold outer air.

Roup is contagious, and when it once gets started in a district the premises of the most careful poultry-keeper are liable to be invaded. Upon this subject the *American Poultry-yard* says: "The fact that fowls sometimes get along amid the filthiest surroundings with no attacks from roup shows that filth and this disease are not inseparably connected. Roup in poultry is like diphtheria in the human subject. It is a disease as different from all other diseases as wheat is from oats, and, like wheat or other grain, must spring from seed. The filthiest drains, cess-pools, or streets near human habitations may not cause diphtheria. Before this disease appears in a locality, the filthy districts and the clean ones are alike exempt, but after it appears the places having the most filthy surroundings offer it the most congenial home, and it is apt to come there soonest, stay longest, and show the most severity at such places. But the cleanest, neatest families are not entirely exempt from diphtheria either. Just so when roup is not epidemic, the fowls in the foulest poultry houses escape its ravages; but when it is prevalent in a country or section, it thrives and shows the most malignant form in damp, dirty fowl-quarters."

But the poultry-keeper who carefully avoids all the known causes of the disease, and takes proper sanitary precaution when it is in his immediate neighborhood, will have but little cause to fear the roup. If it comes it will generally be of a mild type, and easily controlled. Roup generally commences with hoarseness and sneezing, and while in this stage may be easily cured. In the second stage, the eyes swell, the nose and eyes discharge a thin watery substance that thickens and becomes very offensive as the disease progresses. In the third and last stage ulcers form in the mouth and throat, and sometimes around the eyes; in many cases one or both eyes are closed; the head swells, the comb turns black; the fowl loses its appetite, and soon dies.

When the roup makes its appearance among the fowls, separate the sick from the well at once, and proceed with the cleaning and disinfecting exactly as recommended for the treatment of

cholera. As the disease is communicated from one fowl to another by the discharge from the nostrils and eyes, particular attention should be paid to the cleansing and disinfecting of feed troughs and drinking vessels. For this purpose use the disinfecting solution of copperas, carbolic acid, and water. If the sick fowls have not advanced beyond the first stage of the disease, give them a large dose, say a dessert-spoonful apiece of castor-oil at night, and for the next three or four days feed only cooked food, with plenty of pepper or ginger, and pulverized charcoal mixed in; give the Douglass mixture freely in the drinking water, and it would be well enough to give three drops daily for two or three days in succession of the solution of carbolic acid recommended for cholera. This course of treatment will generally cure in a week.

If the disease reaches the second stage before treatment is begun, give the dose of castor oil, and afterwards use "German Roup Pills," according to directions. The genuine German roup pills will cure roup if used before the disease reaches the last stage. Besides the pills give the charcoal in the food and the Douglass mixture in the drink. If ulcers have commenced to form in the mouth or throat, dust them twice a day with powdered chlorate of potash. Give the apparently well fowls the charcoal and the Douglass mixture until the disease disappears from the place.

After the roup reaches the third stage, the fowl is not worth fussing over; kill it and bury or burn the whole carcass.

Use care in handling roup-y fowls; if any of the discharge comes in contact with the eye, or with a cut or scratch on the hands, it will produce serious inflammation.

Gapes in chicks are caused by the presence of minute worms in the windpipe; when these worms are present in great numbers they completely fill the windpipe and the chick dies of suffocation. The name of the disease sufficiently describes the symptoms. It occurs most frequently during the summer months, and among chicks that are kept in filthy coops and runs, fed on sour, sloppy, unwholesome food, and allowed access to impure, stagnant water. Fresh, wholesome, cooked food

until the chicks are old enough to swallow wheat and cracked corn, milk, or plenty of pure water, perfect cleanliness about the coops and run, and an occasional dash of pepper in the food will prevent gapes, unless the disease has been on the premises before; in that case give the Douglass mixture in the drink twice or three times a week, and scatter air-slaked lime freely about the places formerly used for the coop and runs. When possible, keep the chicks on a fresh piece of ground some distance from the old runs.

To cure gapes fumigate with carbolic acid; it will cure when the chick is apparently at its last gasp. Shut the afflicted chicks in the upper half of a tolerably tight box, and put several drops of the acid on a red hot shovel held in the lower half. Keep them in the fumes a minute or so, but watch closely lest they be suffocated. Instead of fumigating all at once, the chicks may be treated one at a time by having some one hold the hot shovel and drop on the acid while you hold the chick's bill open over the fumes that rise. After fumigating, give each chick two drops of the solution of carbolic acid and water. When the acid is not at hand fumigate with sulphur; and if neither be available give each a pill of camphor gum half the size of a small pea.

Another cure, recommended by the *Poultry World*, is to shut the chicks in a box having a cover made of thick muslin, spread air-slaked lime on top of the cover and then strike or jar so as to sift some of the lime down into the box; the lime causes the chicks to sneeze and throw up the worms. Chicks that have died of the gapes should be burned or buried deep, with plenty of quick-lime.

Chills among young chickens, ducks, and turkeys are caused by a thorough drenching with cold rain or dew. When the "patients" are discovered before life is quite extinct, warm them thoroughly by dipping all but the head in quite warm water for a few minutes; then, as soon as they are able to swallow, give a teaspoonful of quite strong pepper tea and put in a warm place until they are quite dry and lively. In extreme cases give a teaspoonful of whisky instead of the pepper tea.

Cramps in the legs of chicks are caused by tramping around in the grass when it is wet with dew or rain. Bathe the feet and legs with coal-oil, or with strong mustard water, give cayenne pepper in the food, and keep the patients in a warm, dry place till quite well.

Scaly Legs are caused by the presence of minute insects, which burrow under the scales and thus cause the legs to assume a rough, bumpy, unsightly appearance. Coal-oil will cure every time. Pour a sufficient quantity in any old tin and dip the fowls' feet and legs in up to the feathers; hold them there a few minutes until the oil has time to penetrate beneath the scales and kill the insects. Repeat this treatment every other day until the scales begin to loosen and fall off; then rub on fresh lard or sweet oil every day until the legs present a smooth, healthy appearance. Usually three applications of the coal-oil will be sufficient.

Leg Weakness.—Sometimes chicks of the rapidly growing breeds "outgrow their strength," and fail up in the legs when from three to five months of age. Sometimes this is caused by lack of constitutional vigor, but oftener from lack of bone-forming material in the food. In the latter case the remedy is obvious; in the former there is no help.

Rheumatism is generally confined to old fowls, and is usually caused by damp houses and cold, swampy yards. The symptoms are lameness and stiffness of the joints of the legs. Put the feet and legs in mustard water (an even teaspoonful of pure ground mustard to a quart of water) as hot as they can bear for ten minutes; then wipe dry and rub with "Magic" oil, coal oil, or any good stimulating liniment. Give ginger and pepper in the food and Douglass mixture in the drink. Continue the treatment daily until the fowl shows signs of improvement; then every other day or every third day until they are cured. Keep in a dry place.

Canker in fowls should not be neglected, for it is often a forerunner of roup in its worst forms. Chlorate of potash will always cure if used in season. Dust the canker spots with the dry powder twice a day. Keep fowls that have canker apart

from the rest of the flock, and cleanse feed troughs and drinking vessels before they are used for other fowls.

Bumble-foot is a lump on the bottom of the foot, and is usually caused by jumping from a high perch on to a hard floor. When the lump appears to contain matter, cut it open, press the matter out, wash the foot with warm castile soap suds, and keep the fowl in a separate coop on a bed of straw until the foot is well. To prevent this disease put the roosting perches nearer the floor, or cover the floor with four or five inches of dry earth, or else make a ladder for the use of the fowls.

Diarrhœa among young chicks is caused by indigestion, arising from weakness of the digestive organs, which is caused by lack of gravel, and by improper food. Chicks that are fed on proper food, and supplied with coarse sand, or gravel of a suitable size, are never troubled with this form of diarrhœa. Sometimes a cure can be effected in the early stages of this disease by giving a half teaspoonful of castor oil at night, and the next morning a small pill made of equal parts of powdered chalk, rhubarb, and cayenne pepper, wet up with camphor enough to mold into shape. A pill for a chick one or two weeks old should be about half the size of a common pea. Skip a morning and then give another pill, and so on until you have given three. Give Douglass mixture in the drink every day until the chicks are well. Feed cooked rice and stale bread soaked in milk and seasoned with pepper. Older fowls are sometimes attacked by this form of diarrhœa, and it proceeds from the same causes. Give one of the pills (as large as a common-sized pea) daily until the fowls show signs of improvement. Give also plenty of burnt bone, food that is easily digested, and the Douglass mixture once a day. Diarrhœa sometimes becomes chronic, and for that I recommend the hatchet.

Frost Bites.—Thaw by rubbing with snow or ice water; then bathe with camphor and afterwards with sweet oil.

Crop-bound.—When you see one of your fowls going around with a crop that looks twice as big as it ought to, catch her, and if the crop is hard and swollen, you may conclude that

there is some obstruction in the passage from the crop to the stomach. Pour some warm water down the throat, and then knead the crop gently until the contents seem soft; then hold the head down and the bill open and work at the crop a few minutes longer. Next, give a tablespoonful of castor oil, and shut the fowl up without food for twelve hours or more. If this course of treatment does not benefit the fowl, cut open the crop, and remove the contents with a teaspoon handle. Make the cut, which should be about an inch long, near the top of the crop. After the crop has been emptied, oil the finger, and pass it carefully, as far as possible, down the passage to the stomach. Lastly sew up the cut, but don't sew all the edges up together; take two or three stitches in the cut of the crop, and then sew up the outer skin separately. Keep the fowl on soft cooked food, and but little of that, and away from the other fowls for a week or so. Give no drink for two or three days after the operation. In making the cut take care not to injure any large blood vessel.

Egg-bound.—When a hen mopes around with hanging wings, appears in distress, and goes often to the nest, but does not lay, she is egg-bound, and the first treatment should be a large dose, say two tablespoonfuls of castor oil; if this does not give relief within a reasonable time inject sweet oil into the oviduct.

Eggs Broken in Oviduct.—Inject a teaspoonful of castor oil or sweet oil, but in nine cases out of ten the hen will die.

Apoplexy is caused by high feeding and exposure to the heat of unshaded yards during hot weather. Sometimes the fowls that are threatened with an attack appear dizzy, but generally they just fall over and die without giving any previous warning of disease. When a dizzy fowl is discovered, pour cold water on the head; then give a dessert spoonful of castor oil, and put the fowl in a coop placed on the ground in a shady place. Give no food for a day or two, then moderate rations of unstimulating food.

Soft-shelled Eggs, and eggs without shells, result from lack of shell-forming food, and sometimes from inflammation of

the oviduct caused by over-stimulating food, and by the excessive use of "egg-food." The remedies are evident.

Egg-eating.—Fowls that have all their wants supplied, and have plenty of exercise, never learn to eat their eggs unless they first get hold of a broken egg, and thereby find out that raw eggs are good. To guard against such accidents, gather the eggs daily, furnish artificial nest-eggs, and do not throw egg-shells to the hens. If you have only one or two egg-eaters, kill them at once (unless they are specially valuable), for one egg-eater will soon teach the trick to every fowl on the place. But if the majority of the fowls have taken to devouring the eggs as fast as laid, arrange the nests so that they will be quite dark inside (better do that any way), and have a few peppered eggs around in sight; also furnish exercise by scattering small grain among the litter on the floor. To prepare the peppered eggs, chip out a small piece of shell from one side of an egg, scoop out most of the contents, fill the cavity with red pepper mixed very thick with the white of an egg, and paste a piece of white paper over the hole. One or two bites of these prepared eggs will convince the erring fowls that "things are not what they seem."

Feather-eating.—Use Loomis's poultry-bit; it is the only sure cure that I know of.

Moulting is not a disease, but it is a critical time for old fowls unless they are well taken care of. Give free range, feed well, give the Douglass mixture in the drink three times a week, and the fowls will come through all right.

Obscure Diseases of Chicks.—It sometimes happens that chicks free from lice, well fed, well housed, and well cared for in every respect, will droop around and finally die without any apparent cause for their untimely taking off. But nothing ever happens in this world without a cause somewhere, and such cases the cause may be found in the parent stock. Chicks from fowls whose constitutions have been weakened by disease, or from those whose vitality has been lowered by any cause, will invariably be a weak, sickly lot, and if they do not die off from sheer weakness they will readily succumb to the first poultry disease that comes along.

CHAPTER XX.

BEES AND BEE CULTURE.*

APICULTURE has attained no mean rank among the manual labor pursuits of our country. Every town and almost every neighborhood has its bee-keepers, some merely amateurs, with from five to twenty colonies, others specialists, with from fifty to one or two thousand colonies. The average yield of honey, where the bees are well cared for, is not less than from fifty to seventy-five pounds per colony; while from one to three hundred pounds are not uncommon as the product of a single colony and its increase during the honey season. The aggregate annual honey product of the country runs so far up into the millions of pounds that the cash value in dollars is now reckoned by millions.

The importance of this industry is further attested by the number and influence of its associations, and by the extent and character of its literature. We now have the North American Association, numerous State and inter-state societies, while the number of county and district associations in some States is not less than eight. The meetings of these associations are large, and do very much to foster the art.

There are now eight excellent periodicals in the United States devoted to bee-keeping, one of which is a weekly. Nearly every agricultural paper has its department of the apiary, which is also found in many of the general newspapers. There are also six excellent books devoted to this art, all of which are admirable. Three of these are large, full, recent, and invaluable to the wide-awake bee-keeper. One of these, "Bee-keepers' Guide," by the author of this paper, first appeared in 1876, and

* By PROFESSOR A. J. COOK, of the Michigan State Agricultural College.

is now in the thirteenth thousand. All of this shows the interest felt in apiculture, which could not exist were it not that there are generous profits to sustain it.

Apiculture as an avocation possesses rare advantages. It gives fresh air, exercise, and health, especially to those of sedentary habits like lawyers, doctors, and divines. Langstroth and Dzierzon are both clergymen. It affords healthful recreation to the student, and greatly strengthens the mental and observing powers. It takes but little time and labor, when carried on in a small way, and from the physical ease with which an apiary can be conducted, by careful planning, it affords special inducements to the women. Some of our most intelligent and successful American bee-keepers are ladies. Mrs. Harrison, of Illinois, and "Cyula Linswick," of Michigan, rank among our first apiarists.

Hindrances to the Industry.—The fear of stings is the great barrier in the way of the spread of this vocation. Many persons have such a dread of bees that they can not be induced to go near them. Those who suffer great pain when stung, and who are so susceptible to the poison that the swelling is great and the fever and irritation long and severe, should not enter this field. It may be said, however, that to many who suffer considerably at first, frequent stings seem to bring relief. The poison inoculates the system, and soon there is no swelling and little suffering from being stung. I have known a large number of such cases. All who are not severely affected with the poison need not hesitate; for with the appliances at our command stings are easily avoided, and very soon all this fear and nervousness will entirely disappear.

Requisites to Success.—There are a few qualities that we must have would we succeed. The would-be bee-keeper must have persistence. Many are faint-hearted, and give up before experience even could promise any considerable success. Again, the candidate for successful apiculture must be mentally active, and by a thorough study of our best books make himself fully conversant with the history and habits of the bees, and the methods which are practiced by the most prosperous apiarists.

His mental energy must also keep him, by aid of the admirable periodicals, fully abreast of all the latest discoveries and inventions which bear on his business. Most important of all, he must be prompt to do the work of the apiary exactly on time. Neglect is the cause of nearly all the failures in apiculture. With but few bees we may be successful and have some regular business besides our bees; but we must be sure that when our bees need our care and attention that they surely have it.

Natural History of Bees.—In every colony of bees there are, in mid-summer, a queen, a few hundred drones, and several thousand workers.

The Queen is the only fully developed female in the hive. She lays all the eggs, and has no other function. The queen (Fig. 1) is long and tapering, her mouth parts weak, her wings short, her sting curved, and her posterior legs without the pollen-baskets of the worker bees. She is much longer and slimmer than, either the drones or workers, and though not as large as the drones, she is a little larger than the workers, so that an aperture that will just permit a worker to pass, three-sixteenths of an inch, will effectually blockade both queen and drones.



FIG. 1.—QUEEN BEE. *

The queen's abdomen is long and plump, as it contains the many tubed ovaries in which grow the thousands of eggs. The queen often lays as many as two or three thousand eggs a day. The eggs pass from the ovaries through a tube—the oviduct. On the side of this (Fig. 2) is a sack, the spermatheca, which contains the sperm-cells which were received from the drone when mating took place. It is estimated that this sack sometimes holds one thousand million sperm-cells.

The queen is developed in a special cell (Fig. 26), which looks much like a thimble or peanut. This is usually built on the edge of the comb, extends downward, and is much larger than the other cells. The cell, in natural swarming, receives an egg directly from the queen. In case a queen is killed or removed the bees will build a queen cell about a worker larva of some age, and thus hasten the advent of a queen, though pre-

* The illustrations in this article are from *Cook's Bee Keeper's Guide*.

sumably not so good a one. In three days the egg hatches. The queen larva—most would call it a worm or maggot—is fed liberally of a rich food, called by the keepers royal jelly. So much of this rich food is given her that there is always some

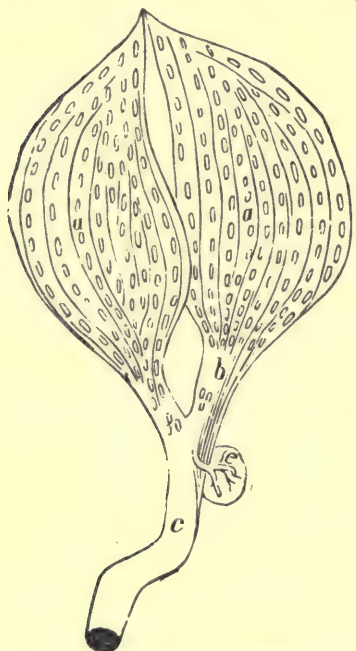


FIG. 2.—OVARIES OF QUEEN.

more than she will need or use. In five days the worker bees cap the cell. This is eight days from the laying of the egg. The queen larva then spins a cocoon, and in eight days more—sixteen days from the laying of the egg—she comes forth from the cell. In three days, if the day is pleasant, the queen flies forth to meet the drone, as pairing always occurs on the wing. When she returns from a successful marriage flight the evidences of coition will appear in a white thread hanging from the tip of her abdomen. If she fails to find a drone the first day she will go forth on succeeding days till mating is accomplished. In two or three

days after the queen mates she commences to lay eggs.

After mating is accomplished a queen never leaves the hive again except as she goes with a swarm. The queen, if a good one, will often live three or four years. There is a great difference in the fecundity of queens. Some lay so abundantly that the hive is kept overflowing with bees; others are so impotent that the colony is always weak and inefficient. The difference is owing partly to ancestry, and partly to the care she receives while yet in the larva state. If a queen fails to mate for twenty days after she issues from the cell she will ever be worthless.

The Drones.—The drones (Fig. 3) are the male bees. They are not as long as the queens, but much stouter and more robust than either queen or workers. Like the queen, they have short mouth parts, and no pollen-baskets on the

posterior legs. Unlike both the queen and workers, their eyes meet above, on top of the head, and they have no sting. When they fly they make a great noise, and though entirely powerless to do harm, they often frighten the young bee-keeper more than do the workers. The drone organs (Fig. 4) are much like those of other male insects. In coition the tube forming the penis, and which holds the sperm-cells, turns inside out, when certain scale-like projections point back. This is caught in the vulva of the queen and held



FIG. 3.—DRONE.

fast, so it is torn from the drone, causing instant death. This is the white thread which hangs to the queen for a day after copulation, and which speaks certainly of her success.



FIG. 4.—MALE ORGANS.
OF BEE.

The only function of the drones is to fecundate the queen, which act is always performed while on the wing. Successful coition seems to demand the fullest activity of the drones. In flight the muscles are tense, the air-tubes full; and so the tension on the abdomen necessary to extrude the male organ, and force out the full measure of sperm-cells, is only possible at such times. Hence fecundation in confinement will probably never be desirable, if practicable.

The reason for so many drones is that the queen may soon meet a drone when she flies forth, and so escape danger from bird or other enemy.

The drones are reared in the large cells, (Fig. 10, a) which are one-fourth of an inch in diameter, and when capped reach beyond the face of the comb, so they are a little more than one-half of an inch long. Like all broad cells, the capping is convex, while that of honey is concave. The projection of drone brood makes it very conspicuous. The capping of brood is always darker than is that of honey. The eggs from which drones hatch are un-

impregnated; that is, they contain none of the sperm cells. In laying an egg the queen may voluntarily withhold the sperm cells by not compressing the muscular spermatheca, which she always does when laying in drone cells. Unmated queens and fertile workers—really undeveloped queens—which are physically unable to mate, frequently lay eggs. These always produce males or drones. Such drones are functionally perfect. The micro-

scope shows that sperm cells are always absent in eggs from drone cells, and that drones from unimpregnated queens and fertile workers are sexually perfect.

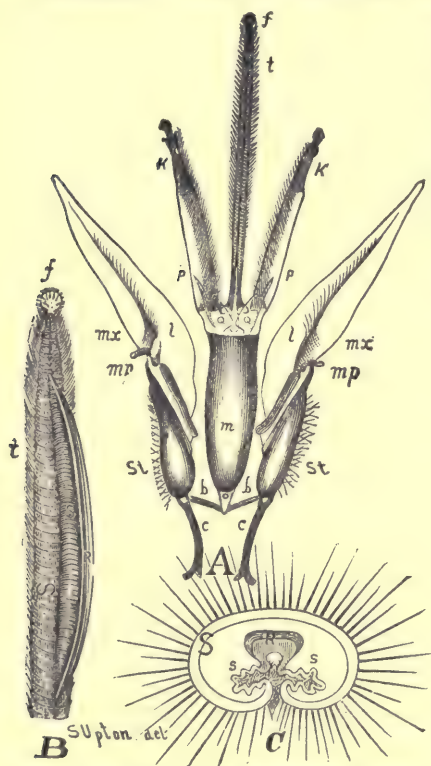


FIG. 6.—TONGUE OF A WORKER BEE, MUCH MAGNIFIED.

mx, mx—Maxillæ.
c, c—Cardos.
st, st—Stipes.
l, l—Lacinia.
s—Colorless membrane.
S—Sheath.
A—Maxillæ and labium.
mp, mp—Max. palpi.
o—Sub mentum.
m—Mentum.
p, p—Paraglossæ.

B—Ligula, with sack dis-
tended.
f—Funnel.
C—Cross-section of ligula.
R—Tubular rod.
k, k—Labia palpi.
t—Tongue.
f—Funnel.
R—Tubular rod.
s, s—Colorless membrane.



FIG. 5.—WORKER BEE.

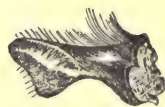


FIG. 7.—JAWS OF BEES.



FIG. 8.—LEGS OF BEES.

That drone bees—the same is true of wasps and ants—are the result of agamic reproduction or parthenogenesis, is as thoroughly demonstrated as any

law in science. It was first shown by the great German bee-master, Dzierzon.

The drone bee is longer in developing than either queen or worker. It is twenty-four days from the egg to the fully devel-

oped drone. The drones are only present in the hive at the season when mating is liable to occur. They usually appear soon after the fruit bloom, and remain till the close of the season, when the worker bees drive them from the hive, and so worry them that death must prove a sweet relief. It is probable that drones live till functional activity, accident, or the general massacre at the close of the season ends their existence.

The Worker Bee.—The worker bee (Fig. 5) is an undeveloped female or queen. The ovaries are mere rudiments. These bees are much shorter than either queen or drone. They are but little more than one-half of an inch in length. The tongue is very long (Fig. 6). Their jaws (Fig. 7) are strong. Their pollen baskets (Fig. 8) on the outside of the hind legs are deep and well fitted to carry the pollenarious food. Their stings (Fig. 9) are strong. These are composed of three parts, and the two outer portions are barbed, so that when once inserted they can not be withdrawn, and so are pulled out, which proves fatal to the bee. The poison is held in a muscular sack, and is pressed out through the barbed pieces when the sting is used.



FIG. 9.—STINGS WITH LANCETS. DRAWN ONE SIDE, CROSS-SECTION OF STING, AND A LANCET, MUCH MAGNIFIED.

- | | |
|--------------------------------|---------------------------------------|
| c—Poison Sack. | B, B—Lancets. |
| A—Awl. | O, O—Openings from hollow in lancets. |
| U, U—Barbs. | S—Reservoir. |
| I, I—Hollows in lancets. | E, E—Valves. |
| T—Groove in lancet. | H—Hollow in awl. |
| M—Tube from sack to reservoir. | T, T—Ridges in awl. |

The tongue of the workers (Fig. 6) is very complex. It is really a tube slitted along the under side, but the sides of the slit can be approximated so that it really becomes a tube. By its use the bees can sip slowly from long flowers, rapidly from a full drop of honey, or can lap the liquid sweets from a thin surface. With their jaws (Fig. 7) they knead the wax and

fashion the comb. Large glands in the head and thorax enable them to change the nectar to honey as they bear it from flower to hive. A large sucking stomach, anterior to the true stomach, is the engine which draws in the nectar, and the reservoir in which it is stored in transit from blossom to honey cells. The large, deep pollen baskets permit the storing of pollen or glue, that it may be borne from flowers or buds to the hive. The sting enables them to defend their home and stores, even though done at the sacrifice of their own lives.

The worker has come from impregnated eggs, and are developed in the smaller horizontal cells. (Fig. 10, *c*.) They are sparingly fed, and are twenty-one days from egg to winged bee. The function of the workers is to do all the work of the hive. The older bees, those over two weeks of age in a large normal colony, gather the nectar, collect the pollen and bee glue, and defend the hive. The young bees make the comb, nurse the brood, cap the cells—in fact, are the housekeepers. In case there are few young bees, the old bees may secrete wax and work indoors, while if old bees are scarce, young bees will commence to gather before they are two weeks old. The worker bees may live several months, as they do in winter. In the busiest part of the year they live only about forty-five days.

Races of Bees.—There are several well marked races of the *Apis Mellifica*, or Honey Bee.

BLACK OR GERMAN BEE.—These are black in color, modified slightly by more or less gray hairs; are rather ill-tempered, have a shorter tongue than other races, are not so prolific as the yellow-banded bees, and so are generally being replaced by other bees. They are, however, quicker to enter sections than the yellow bees, and by adding thicker cappings make a little nicer honey. There are several varieties of this race, as the Carniolan, Heath, etc.

ITALIAN BEES.—These have three yellow rings just back of the thorax. The first is narrow, the second wide, the third intermediate. If pure, every bee will possess these three bands. The queen will be solid yellow on the back to near the tip of the abdomen; while the drones will have large patches of yel-

low. The queens direct from Italy seem very vigorous and rather darker than those reared in America. Italians are handsome, active, have long tongues, and are very prolific, are easily handled, as they are very amiable, and the queen is easily found. All these characteristics are very desirable. A variety of the Italian with white hair is called Albino.

SYRIANS.—These bees, first imported by Jones & Benton, are much like the Italians. The workers are more yellow beneath, and when they first come forth from the cells are shorter and very dark. The queen is ringed the whole length of her abdomen. The drones also have regular rings, which are of a silvery yellow. These bees have all the excellencies of the Italians, except that they are not so amiable. They are very prolific, and unlike most bees, keep on breeding even though the workers are not gathering. I have handled them now for three years, and have no trouble with their irritability. I think they are the best bees yet domesticated.

CYPRIAN BEES.—These bees are much like the Syrians, from which they doubtless sprung, only they are more cross.

Products of Bees.—**HONEY.**—This is the most important bee product. It is not made but gathered, although the nectar of the flowers is somewhat changed as it is conveyed to the hive. Nectar contains more cane sugar than does honey, and is neutral in its reaction, while honey is acid. The nectar and the fresh honey is often very thin, but in the cells it soon evaporates. The bees never cap over the cells containing honey till by evaporation the honey becomes thick. Honey, unless kept above 70° F., will crystallize or granulate. This is no injury; in fact, is one of the readiest tests of purity. It is true that some honey never candies, though for the most part honey crystallizes, so that it is a suspicious circumstance if honey refuses in cold weather to granulate. By heating honey to 180° F., and sealing it up air-tight, it will remain liquid indefinitely. Candied honey can be readily reduced to the liquid state by heat. If only heated enough to melt it, it is just as good as before it crystallized. As honey is more easily transported when granulated, and as granulation in no wise injures it, we

may consider this peculiarity of honey a great advantage. The function of honey is to serve as food for the mature bees, and when mixed with pollen for the brood.

WAX AND COMB.—Wax is in character and composition much like fat. It is secreted by the worker bees in scales, in eight little wax pockets beneath the abdomen. When the hive is destitute of comb, nearly all the bees are engaged in secreting wax; while on the other hand, if the hive is full of comb, few of the bees secrete wax. The function of the wax is to form comb.

COMB.—(Fig. 10) is a very, thin, beautiful structure made from wax. The cells are hexagonal, consisting of a hexagonal prism resting on a triangular pyramid. The cells vary from one-fourth inch (Fig. 10, *a*) in diameter—drone cells—to one-fifth of an inch (Fig. 10, *c*) worker cells. Two or three rows of cells (Fig. 10, *b*) between the drone and worker comb, are irregular in size, neither worker or drone size, but answer well for honey. The queen cells and brood cappings of all cells are partly composed of pollen, and so are more dark, brittle, and

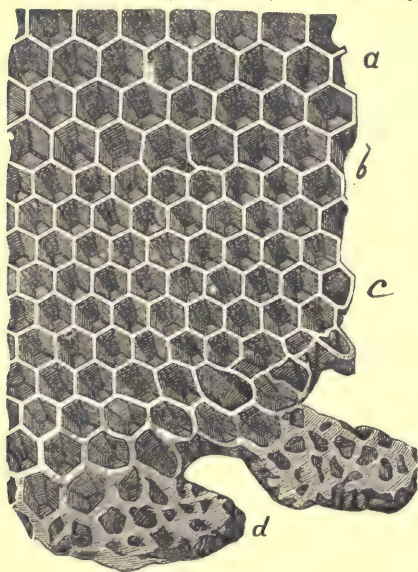


FIG. 10.

porous. The function of the comb is to afford storage for honey and pollen, and to serve as a place to rear brood.

POLLEN.—This is the “bee-bread,” and is merely the gathered pollen from flowers. It is carried to the hive in pellets packed into the pollen baskets on the outside of the posterior legs. The carriers scrape it off into the cells, when the other bees pack it. Bees sometimes gather flour, meal, etc., when there is no pollen to be found in flowers. Pollen contains all the necessary food elements, including nitrogen, and so is a typical food. The bees can not rear brood without pollen. The function of pollen is to feed the bees and brood.

PROPOLIS.—This is the bee glue. It is gathered from resinous buds and varnished furniture. It is collected and carried the same as is pollen. Its function is to seal up crevices, make all tight about the hive, and cover up any obnoxious substance, which can not be removed. The bees will thus entomb mice, bumble-bees, etc.

Practical Bee-keeping—HIVES AND SECTIONS.—As the bee-keeper must have hives, and as he can not afford to have different styles in his apiary, an early consideration of hives is desirable. No intelligent bee-keeper, no one who aims at certain success, will use box hives. They permit no examination of the bees, enforce ignorance, and are worse than worthless relics of the olden time. To Rev. L. L. Langstroth, inventor of the first practical movable frame hive, American apiculture is more indebted than to any one else. His great invention is what has lifted apiculture into the proud position which it holds to-day.

Let it be stated and emphasized right here, *that there is nothing at present about the hives used by the ablest and most progressive apiarists that is covered by a patent.* The vender of patent hives never finds a listener, even, among our informed bee-keepers.

LANGSTROTH HIVE.—As this is the hive that is almost universally used by bee-keepers, I will describe no other. The hive, as preferred by its inventor (Fig. 11) was rather shallow, with a long, shallow frame. This might be one and one-half or two story, as shown in the figure. In my own experience, after a trial of various forms of hive, I have been most pleased with the square frame. The one I prefer is styled the Gallup frame. I will describe the hive that I prefer.

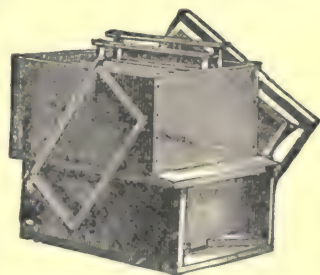


FIG. 11.—LANGSTROTH HIVE.

The body of the hive (Fig. 12, *a*) is simply a box made of clear pine or white wood, without top or bottom, one foot wide, two feet long, and eleven and one-fourth inches high. One inch from the top of this, about the outside, shoulder strips (Fig.

12, *b*) two and one-half inches wide are nailed. Just on the inside, at the upper edge, sheet iron or heavy tin strips (Fig.

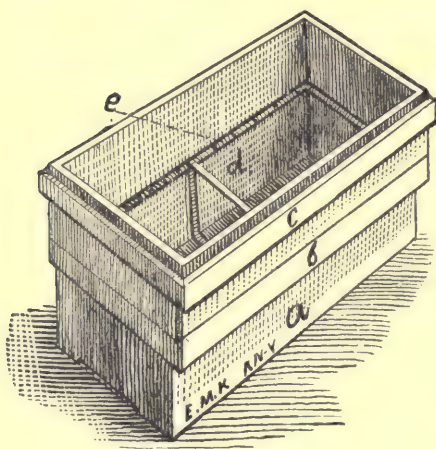


FIG. 12.—HIVE.

13, *e*) three-fourths of an inch wide are tacked, so as to project above one-fourth of an inch. On these rest the frames (Fig. 12, *d*). This keeps the frames from being glued fast to the hive. In the middle of one end at the lower edge, a strip eight inches long and three-eighths of an inch wide is sawed out to form an entrance.

The bottom board (Fig.

13, *a*) is four inches longer and

two inches wider than the hive. It is nailed fast to supports (Fig. 13, *bb*), which raise the hive four inches from the earth. This is not nailed fast to the hive, though some prefer to have it (Fig. 11). The alighting board (Fig. 13, *c*) I also prefer separate. The figure explains its construction.



FIG. 13.

The second story, or rather half story (Fig. 12) is also a box without top or bottom, two inches longer and two inches wider than the body of the hive, and only eight inches high. This also has shoulder pieces (Fig. 12, *c*), on which may rest the top. When in position this second story shuts around the body and rests on the shoulders (Fig. 12, *b*), as seen in the figure.

The cover (Fig. 14) I make with a gable, as it dries off

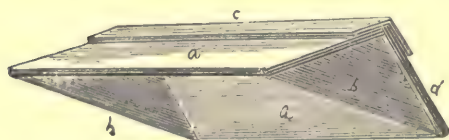


FIG. 14.—COVER.

quicker after a rain, is not so apt to leak, and looks better.

This shuts around the upper story and rests on the shoulder pieces (Fig. 12, *c*).

Some prefer to have the entrance cut into the bottom board

(Fig. 15), rather than in the hive, where we may close the entrance by simply pushing the hive back. Many bee-keepers prefer

a two-story hive (Fig. 15) so that the upper story may take a frame the same as the lower story. In such cases the parts may join by a rabbet or a bevel (Fig. 15), when the cover may hinge on to the upper story. Some also cut a rabbet on the inner upper edge to receive the frames (Fig. 15), but after trying all styles I think the style described

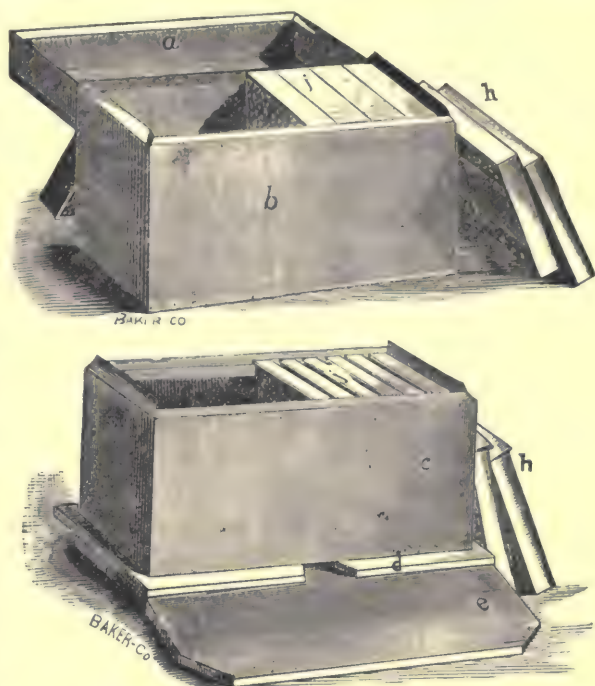


FIG. 15.—TWO-STORY HIVE.

above is, on the whole, the best for the practical bee-keeper.

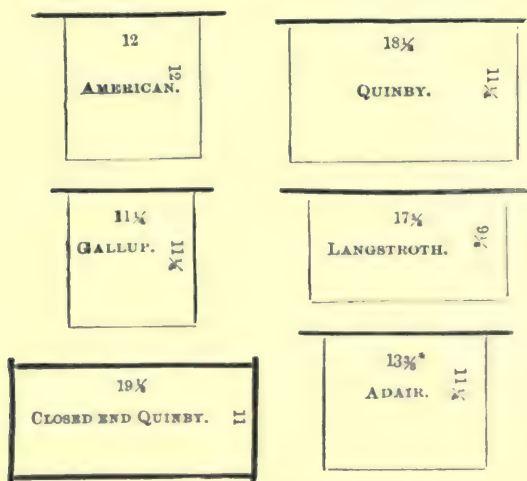


FIG. 16.—FRAMES.

The frames used in the country (Fig. 16) are very variable. As already stated, I prefer the Gallup, which is eleven and one-fourth inches square outside measure. It fits the hive already described. For top-bar I use strips twelve and one-half inches long, one inch wide, and three-eighths of an inch thick. It is

very desirable to have strong top-bars. The end pieces are ten and three-fourths inches long, one inch wide, and one-fourth inch

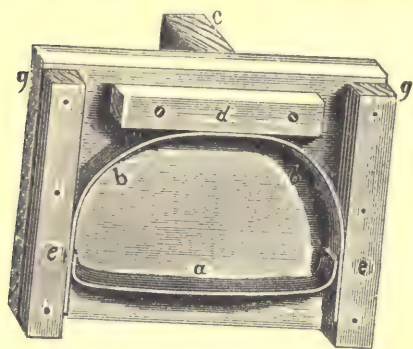


FIG. 17.

thick. The bottom piece is eleven and one-fourth inches long, one inch wide, and one-eighth of an inch thick. The ends of the top-bar will project five-eighths of an inch, so that the frames may be suspended in the hive (Fig. 15).

It is *very important* that the frames should always be right-angled, perfectly true, and all

absolutely alike in form and size. To secure this, they should be made with a gauge. The one I use (Fig. 17) is very handy.

The steel spring (Fig. 17, *b b*) holds the end-bars in place till the top-bar is nailed, when it is turned upside down and the bottom-bar tacked; then by pulling down on the strap (Fig. 17, *a*) the steel spring is drawn away from the frame, which can be taken out all complete and perfect. I never use a honey-board above the frames,

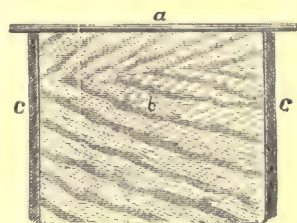


FIG. 18.

but cover with oil-cloth, glazed surface down, in summer, and thick factory in winter. These are cut exactly fourteen by twenty-six inches.

A division-board (Fig. 18), which is the form of a frame, and so made as to make two entirely separate compartments to the hive, when used is very important in every hive. It enables us to confine the space in fall, winter, and spring so that the

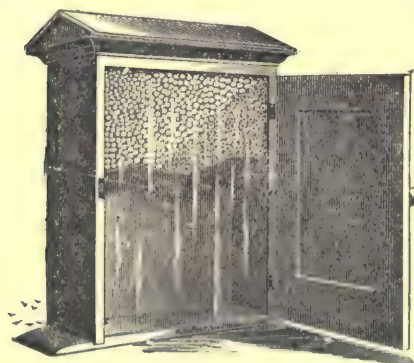


FIG. 19.

bees do not have to heat the whole space. They are also important to enable us to form nucleus hives, soon to be described.

An observation hive (Fig. 19), made to hold only one frame, with sides of glass, protected by doors hung on hinges, will afford great amusement, and afford opportunity for valuable study and observation.

SECTIONS.—These are small, shallow boxes (Fig. 20) to enable us to secure comb-honey in the most marketable form. They should be of white wood, and very neat in appearance. The top and bottom should be three-eighths of an inch narrower than the sides, so when placed together a space is formed that the bees may readily pass through. They may be nailed, united by a dove-tail (Fig. 20), or consist of one piece, and united only at one angle with a dove-tail. They may be from one and three-eighths to two inches thick, and of a form and size to suit the market. A very popular form is four and one-fourth inches square, and two inches deep. This holds a pound of honey. The prize section is five and one-fourth by six and one-fourth inches. Even smaller sections than the one pound are now being used. The smaller sizes seem to sell more rapidly, but it is thought that we can not secure so much honey in them.

FRAMES AND CRATES.—If we use a two-story hive (Fig. 15), then we may hang the sections right in a frame (Fig. 21). The wide tins (Fig. 21, *t*) secure the comb in a more regular form, and are quite necessary if we use sections two inches deep. Of

course the wide frames which hold the sections (Fig. 21, *h*) must have a narrower bottom-bar, so that the bees may pass from the lower story of the hive up into the sections. I have now discarded the two-story hive and these large frames for sections except to use in the lower story of the hive, as I much

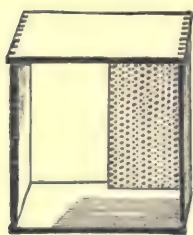


FIG. 20.

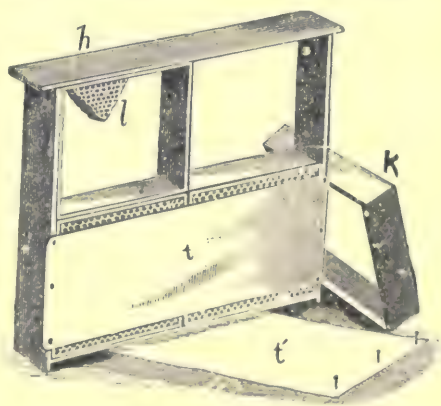


FIG. 21.

prefer a crate. These (Fig. 22) sit just above the frames, in the upper half story, and are very convenient. The bees can not stick them so terribly tight as they do the frames in the two-story hives, and it takes but a moment to lift off the upper half story, remove the crate, and get to the bees in the brood-chamber or lower story. Some bee-keepers hang frames on to

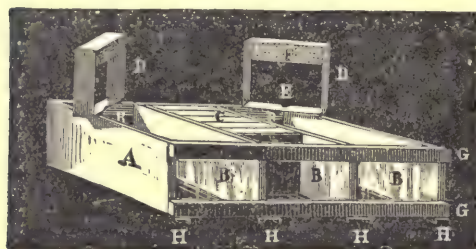


FIG. 22.

the upper story, even when it is only a half story.

I think it is generally more satisfactory to buy our sections where they are made by machinery, as they will be more beautiful, and they can not be too nice.

If we make our own hives, we shall need a circular saw. This may run by steam, water, horse, wind, or foot power, as the extent of our business and our circumstances suggest. I have found the Barnes Foot-power Saw very desirable to be used on a small scale.

LOCATION OF APIARY.—To select a home, if the prospective bee-keeper is not already located, is a matter worthy no little thought. We should aim to locate in the midst of abundant native honey plants of the best sorts, which shall furnish as nearly as possible a constant succession of nectar-secreting bloom. We should also obtain, if possible, a monopoly of these plants. Six miles ought to intervene between large apiaries would we secure the best results. Nearness to a market, or what will answer nearly as well, to a depot or boat-landing, is also desirable.

If we are already located, and are not free to choose, we may still rejoice in the fact that nearly every locality in the United States is so rich in honey-plants that bees may be kept in it at a fair profit. Bees are often kept by our most prosperous bee-keepers in villages, or even in cities. C. F. Muth, the noted apiarist of Cincinnati, keeps his bees on the roof of his store. The special location of the apiary grounds is not material. The ground should be dry, and so a slope to east, south, or west is to be preferred, especially if the soil is wet and heavy. As

shade is very important in mid-summer, a not over-dense grove, trimmed quite high so as to be dry and admit the early and late sun is very nice. Some utilize the apple orchard for the purpose of shade. A grape vine (Fig. 23) or evergreen to the south of each hive furnishes a not very satisfactory shade. Many place the apiary in an open space and shade by use of a piece of tent-cloth fastened just above the hive.

Immediately about the hives we should have saw-dust, gravel, coal ashes, or closely mown grass, as we shall then see without trouble any queen that may fall to the ground as we handle our bees, or that may have defective wings and attempts to wander from the hive at times of swarming.

TRANSFERRING.—The beginner, and even the experienced apiarist, may often be able to buy bees so cheaply in box hives that it will pay to purchase them and transfer them to movable comb hives.

If in the middle of a warm day, when the bees are gathering, we approach a hive and blow enough smoke into it (see article on quieting bees) to quiet the bees, we may then safely turn the hive bottom side up, and by placing a box without cover above the hive, this also being bottom up, we can by rapping on the hive with a stick or hammer for twenty minutes cause the bees to leave the hive and go into the box. Only a few of the young bees will remain behind.

The bees that have been drummed out may now be hived,

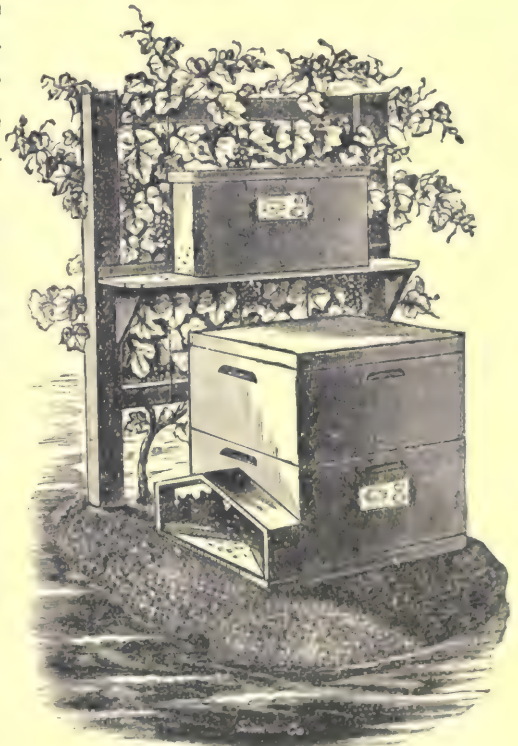


FIG. 23.—HIVE AND NUCLEUS, SHADED BY A GRAPE-VINE.

as in swarming (see article on swarming) in a movable comb hive on a full set of frames filled with foundation. They will quickly draw out the foundation, and soon be as strong as before in brood, etc., and will have a set of combs that will leave nothing to be desired. If this is done while the bees are gathering rapidly nothing further will be required, otherwise the bees will need to be fed till able to gather sufficient for their needs. In such cases from one and one-half to two pounds should be fed daily. A good time to do such work is during fruit bloom or at the dawn of the white clover harvest.

In the old box hive there will remain the comb, honey, brood, and some young bees. By leaving this twenty-four days the bees will be all hatched out and may be drummed out as before and united with the other bees after killing the young queen which they have reared. By shaking the bees in front of the hive the queen will be readily found. By using plenty of smoke, and uniting the bees just at night, they are made to accept the situation amiably.

After this the old honey in the box hive should be extracted, the comb melted up and fashioned into foundation. Mr. Heddon first suggested this valuable improvement in the method of transferring. The only objection to it is the danger of losing the brood by chilling after the removal of so many bees. If the weather is cold, the old hive should be placed in a warm room till the brood has hatched out sufficiently to prevent this.

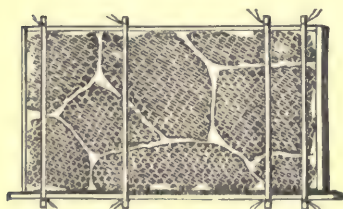


FIG. 24.

The old method of cutting out the combs and removing the brood at once to the frames is expensive of time and does not secure first-class combs. When thought desirable the combs may be fastened in by tacking thin strips of wood on each side of the frames, or wiring sticks in pairs about the frames. (See Fig. 24.) These sticks should be removed in two or three days after the transferring is completed.

FEEDING.—It is often true that flowers cease, either from cold or rain, to secrete nectar, and frequently, generally in fact,

there is a dearth of nectar-secreting bloom in midsummer. At such times the bees are idle, and the queen, as if possessed of wise foresight, ceases to lay. Again, it frequently happens that some colonies will have too limited stores in autumn or spring, and unless fed will starve. As stated in the article on transferring it is sometimes required to feed in that operation.

It will pay then to feed at any time during the season when the bees are unable for a week or more to gather. Such stimulative feeding, as it is termed, often pays remarkably well. At such times a half pound per day is quite sufficient.

In autumn, as soon as the bees cease to gather, unless they have thirty pounds of good capped honey in their hives, they must be fed enough to make this amount.

It is never wise to feed any thing but good extracted honey or syrup made of the best granulated sugar. This last is as good as honey, and should be made rather thin—a quart of water to two of sugar—that it may not re-crystallize.

The requisites of a good feeder are, that it rest immediately above the bees, so that they may reach it, even if the weather is quite cold. It must not permit the escape of heat from the hive, must permit feeding without the escape or disturbance of the bees.

The best feeder I have ever used, and one that fills all the above requirements, was sent me by John Smith, of Massachusetts, and which I have styled the Smith feeder. It is a modified simplicity feeder, and resembles the Shuck feeder, but is much superior to either.

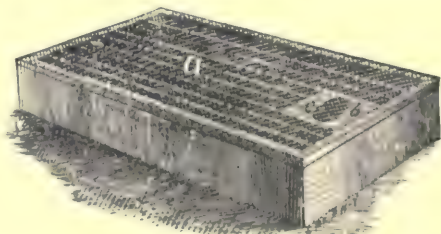


FIG. 25.—SMITH FEEDER.

The Smith Feeder (Fig. 25) consists of a two-inch plank about six by nine inches. In one face of this saw-cuts one-half inch wide are made to within one-half an inch of the bottom, which are separated by thin, narrow partitions. Two or three of the middle cuts do not reach to the end, so that room is left (Fig. 25, *b*) for an inch and a half augur hole (Fig. 25, *c*)

On the edge of the face about the cuts, a rim three-eighths of an inch high is formed by tacking on strips of that thickness. On top of this rim a piece of common wire gauze (Fig. 25, *a*) the size of the feeder, is tacked. To use this, we set the augur hole just above a similar hole in the cloth or honey-board above the brood chamber. As this is the only hole in the cloth the bees can only pass up into the feeder. As the rim raises the wire gauze, the bees can pass freely into all the saw-cuts, but can not pass from the feeder except into the brood chamber. Above the feeder, during the early cold days of spring, a sack of sawdust or chaff may be placed, which serves to keep the heat from escaping from the hive. Between the feeder and this cover I place a piece of shingle or pasteboard, so that the sack will not be daubed after I have fed the bees.

To feed we have only to remove the cover of the hive, raise the sack, if it is on, and the shingle, and turn the feed right on the wire gauze, when it passes at once to the saw-cuts. If some of the bees are in it, no harm is done, as they can crawl up the partitions and down into the hive, when the other bees will soon clean them of their sugar coating. There are many feeders in use, but for cheapness—any planing-mill will saw out the blocks and cut the saw grooves—convenience and excellence, I know of no superior to this Smith Feeder. Many who use close bottom boards pour the feed immediately into the hives. Even if I used such hives I should still desire this feeder.

Bees should *always* be looked after in the fall so as *never* to need feeding in winter. If, however, through neglect the bees get out of stores in winter they should be fed solid, not liquid, food. Cakes of the "good candy," yet to be described, may then be placed immediately above the frames under the cloth cover. Grape sugar, or glucose, should never be used as feed for bees. It is unwholesome, and its use and manufacture even should be frowned upon by the apiarist.

QUEEN REARING.—It is not uncommon at any season for the bee-keeper to find that some of his colonies are queenless; if we practice artificial division, we shall need queens; if we wish to change the race of our bees we have only to introduce a queen

of the desired race into each colony, when presto—the work is done. Again, many find in queen rearing for market a profitable and pleasant employment. Thus it is necessary to know how to rear good queens.

To secure queens of the greatest excellence, they should be fed as queens from the first, and not fed as worker larvæ for one, two, or three days, and then changed to queens. Again, they should be reared in large, vigorous colonies, that they may surely be fed well. We have only to remember that it is only quantity and quality of food that accelerates the development and produces a queen to realize the value of this position. If, however, it is ever considered desirable to rear queens from the start in small colonies, we can make it less objectionable by giving little or no other brood to this colony, so that all effort can be concentrated on the developing queens. Again, queens will be best if reared when the bees are in the height of their activity, during an ample harvest. At such times all work of the hive is pushed with unwonted activity, and so the inchoate queens get better treatment. By stimulative feeding as described in the last article, the apiarist may secure fairly good queens at other seasons than when the bees are rushing the nectar from bloom to hive.

The best queens are doubtless those that come from cells started by the bees in preparation for natural swarming. On such the young apiarist may well depend till wider experience teaches him the way to success by a still more artificial method. By feeding quite early in the spring, at least five weeks before fruit bloom, to stimulate, and by adding brood from other colonies, as they can spare it, the best colony in the apiary may be early made so strong that at the very dawn of the season they will have drones flying, and will have formed queen cells in which the queen will lay eggs. Thus we start out with all conditions most favorable. Besides, we get queens before there are any drones except from this or these best colonies, and so are pretty sure of pure fertilization with but little care.

The regular breeder, or he that wishes to rear queens at all times in a season, can not depend on queen cells naturally

started. In this case a comb of brood in the middle of the hive containing our best queen is replaced by an empty comb, which is new and bright. In twenty-four hours this will be full of eggs. This comb should then be cut off at the bottom, or holes may be cut in it to make place for the queen cells, when it should be placed in any hive containing a strong colony, from which the queen and all eggs and worker larvæ, still uncapped, have been removed. The bees will at once form fine queen cells (Fig. 10) about the edge of the comb that was introduced, containing the eggs. In eight days these cells will all be capped over and ready to be used in nuclei. If desired, however, each cell may be inclosed in a wire cage, the edge of which is pushed into the comb, and left right in the hive, or the whole frame may be similarly inclosed. As we know that in sixteen days from the time the eggs were laid the queens will come forth, we shall know just when to look for their emergence, and can be on hand to take them out as they leave the cells, when they can be used at once to form nuclei or given to queenless colonies as desired. A virgin queen, just as she hatches, is always received amicably by any queenless colony.

If we form nuclei, the cells must be cut out before hatching and each fastened into a comb (Fig. 26), and with one or two

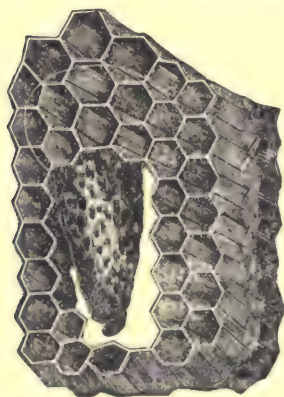


FIG. 26.—QUEEN CELL.

other combs and about a pint to a quart of bees put into a new hive. Some who use large frames make small hives purposely for this, but it is better to use the regular hive for nuclei, whatever the form and size of the frame. By the use of division boards the brood chamber can be reduced so as just to accommodate two or three frames as may be desired. In procuring combs with bees to form a nucleus we may go to any hive in the apiary strong enough to spare the requisite number of combs and bees, but we *must always be very careful* not to take the old queen, as this would render one of our full colonies queenless, and insure the destruction of the queen cell that we

put in the nucleus. One or two of the frames put into the nucleus should contain brood in all stages, as this keeps the bees at work, and so more contented. It is somewhat better to form the nucleus twenty-four hours before we insert the queen cell, otherwise the bees may cut it down and destroy it. Care is also required that too many bees do not leave the nucleus and go back to the old hive from which they were taken. To avoid this we may close the entrance to the nucleus for the first day, care being taken that the bees do not get too little air or too much heat. In sixteen days the queen will hatch out, in three more she will fly forth to mate, and in three more will commence to lay, when our nucleus is changed into a miniature colony of bees.

Some of our best queen breeders use a lamp nursery, and so rear their queens after the cells are capped by artificial heat; but these will certainly not be desired by the beginner.

CLIPPING THE QUEEN'S WING.—This process does no injury to the queen, and as it prevents her ever taking flight, it makes hiving swarms more easily accomplished, and often prevents swarms leaving that would otherwise go forth to parts unknown. I would never think of keeping bees without having the queen's wings clipped. This act should be done while her majesty is yet in the nucleus, as then there are so few bees that the queen is easily and quickly found. To do this pick the queen up by the wings with the right hand, then set her feet on the left hand, and set the left thumb on her feet so as to hold her; then quickly grasp some small scissors with the right hand and clip off one of the front wings. We should be *very careful* not to clip the queen till we see that she has commenced laying; that we may be sure that she has met the drone; else we preclude mating, which must take place on the wing, and so our queen will always be barren or a drone layer, and worthless.

FERTILE WORKERS.—Every nucleus should be given eggs every four or five days, else they may become, if kept for some time queenless, the abode of fertile workers which, as we have seen, only lay drone eggs, and so are worse than useless. If any nucleus or colony is found possessed of these pests it should

at once be united with a strong colony, which contains a vigorous queen.

UNITING COLONIES.—To unite two colonies we first, by moving each a few feet each day, get them side by side. We then set the stronger colony a little to one side, place the other hive which is to receive all the bees midway between where the two just stood, smoke both colonies thoroughly, remove one queen if both colonies have one, then shake all the bees in front of the hive which has been placed centrally as regards the former position of the two, and set the frames of the hives so as to alternate in the hive where the bees are henceforth to stay. As soon as the frames are all adjusted—or so many as are desired—close the hive, and smoke the bees in from the front; so much common trouble unites the bees in one amiable brotherhood. Uniting is often desirable, especially in autumn, when by uniting two weak colonies or their nuclei we secure one strong colony. Every apiarist should remember that strong colonies pay, weak ones never. So uniting at other seasons may often be very desirable and wise.

TO INCREASE THE NUMBER OF COLONIES.—Natural swarming has several objections. It is often carried so far as to seriously weaken the bees. It requires close watching, or bees go off. Hiving a swarm from some lofty tree-top is not always easy, if it is even possible.

If, however, it is practiced, a clean hive should be placed where it is to stand, and the frames either empty or, better, filled with comb, or foundation placed in it. We then manage as best we can to shake the bees in front of the hive. If they are on a limb of a tree (Fig. 27) we may be able to saw it off and bear it to the hive, when by a sudden shake all the bees are dropped on the alighting board, and quickly enter the hive. It may be easier to shake the cluster into a light box or basket, and then quickly carry and turn them down in front of their prospective home.

Hiving is made easier when the queen's wing is clipped. This, too, will prevent the loss of the colony if the apiarist is away. The queen *may* be lost as she will come out of the hive,

and in her attempt to leave may wander off and fail to again find the hive; but the colony will surely return soon after they cluster, as they will not leave without the queen.

To hive a colony with queen's wing clipped, we have only to step in front of the hive as the bees rush out, and catch the queen as she comes forth—usually late in the exit—and cage her. We may simply place her under a tumbler. A cloth is now spread over the old hive, and the new hive placed immediately in front, with the queen in it. Soon the bees will see that they have no queen, when they will break ranks and return, and enter the new hive, which contains the caged queen. When all are in, the hive should be carried to its desired location, and at nightfall the queen should be liberated.

Artificial increase is at times to be preferred to swarming. It is just as good, and in its practice a more equal division is made. To do this we form nuclei, as already described, and then simply build them up into strong colonies by adding bees and brood from other colonies as they can spare them. Here, as in forming nuclei, great pains is required that the old queen is not carried with the bees that are added to the nuclei. When frames of brood are removed from a hive their place should be filled by foundation. This is so valuable that no apiarist can afford ever to put empty frames into his hives.

TO PREVENT SWARMING.—When the apiarist does not wish any further increase, it is sometimes very desirable to keep the swarming impulse in check. This can be done usually by ex-



FIG. 27.

tracting or giving abundant room for the bees to work in. If the bees will swarm, they may be hived with a colony which previously swarmed—a day or two before—after we destroy the queen cells of the latter. They are now just as strong, and in nearly the same condition as before, except their home and location are changed. This will usually stop all further desire to swarm, and the bees will settle down to earnest work in sections or frames. If they still are bent on a march, we can cut this short surely by caging the queen and forming a nucleus with her, which we place just above the old colony (Fig. 23). As she fills the combs with eggs they can be exchanged for empty combs from some needy nucleus or colony. In eight days the queen cells in the old colony may be destroyed, and the queen returned. The bees will have gone to work, and now will think no more of migration.

HOW TO ITALIANIZE.—Italian bees are not only very superior to black bees, but, as they are far more amiable, they are by far the most desirable for the beginner. The new bees, Syrians and Cyprians, introduced by Messrs. Jones and Benton, are in some respects more valuable than are the Italians; but their irritability makes them less desirable than the Italians, especially to the novice.

From what we have learned of the natural history of bees, we see that to change our bees we have only to introduce a new queen. The old bees soon die, and in three months during summer every bee will be changed to the new race.

TO INTRODUCE A QUEEN.—If we take out the old queen, then keep the colony queenless for three days, after which we destroy the queen cells, we may then let the new queen run right in at the entrance, smoking the bees all the time. Mr. Henry Alley says that by use of tobacco-smoke this can be made invariably successful. If a very valuable queen is to be introduced it is best to form a nucleus of all hatching brood with no bees. Put in the queen, and shut up the hive. If this is done at dawn there will be enough bees by night to protect the queen, even if the night is a little chill, and soon we may have a strong colony by adding enough brood.

At present a popular shipping cage is known as the Peet cage (Fig. 28). One side of this is covered by a slide of tin, and on three sides are tin points which may be turned at right-angles to the cage, as seen in the figure. At one end candy is placed in small holes, so as to be of easy access to the bees. To introduce a queen in this cage is easy, and generally successful. We turn the tin points, as seen in the figure, and press the cage against a smooth piece of comb, so it may cover both capped brood and honey. The tin points will hold it firmly to the comb. We now pull out the tin which lies against the comb. Soon the bees cut through the comb by use of their jaws, and liberate the queen, when she is almost invariably well received.

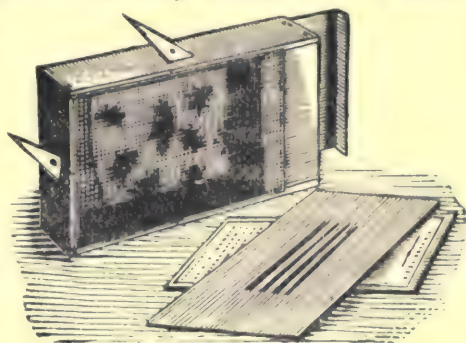


FIG. 28.

SHIPPING QUEENS.—This same cage is very convenient for shipping queens. In this case the wire gauze is covered by a thin piece of wood (Fig. 28), which is held out from the gauze so as to give air, and yet prevent the mail agents from being stung while handling the cages.

THE GOOD CANDY.—While being carried in the mails the bees must have food. It used to be common to give them honey; but this often run out and daubed the mails, which caused the United States authorities to exclude bees from the mails. Owing to the distance of express offices, and the expense of sending by express, this worked great injustice to many. This order was revoked by the mail authorities, but only on conditions that there should always be the double cover, and no food that could possibly soil the mails. This saves hundreds of dollars each year, and no *shipper* should presume to disregard either of these rules. The Good candy is simply granulated sugar moistened with extracted honey, and pressed into small auger holes which are cut out a little from the side of the chamber next the bees, so that the bees can reach the food. This candy

keeps moist, and so will keep the bees in health for a long journey. It should not be too wet, or it will drip; nor too dry, or it will crumble.

SHIPPING BEES.—To ship nuclei or full colonies, great care should be exercised that the frames are so fastened that even the roughest handling will not move them. The combs should be old, so they will not break out, or else wired, as when we use wired foundation. The ventilation should also be ample and perfect. With a large colony, in hot weather, not only the entrance, but the whole top of the hive must be thus covered with gauze.

EXTRACTING AND THE EXTRACTOR.—Extracted honey can be produced in double the quantities of comb honey, and is getting to have a large and regular demand. By extracting swarming can be restricted, and often it would pay to extract even were there no use for the extracted honey, as, unless extracted, the space for brood is so restricted that breeding nearly or wholly ceases. Well then has it been said that few apiarian inventions equal in value the honey extractor.

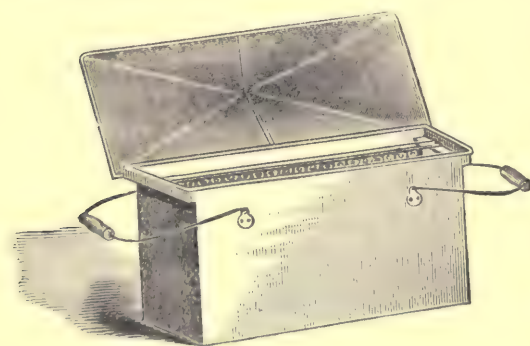


FIG. 30.

have a molasses gate for a faucet, and should have a movable wire basket to use in extracting from pieces of comb which break out of the frames.

To extract, we ought to have a comb basket (Fig. 30), which shall hold all the frames of a single hive, and shall have close covers. To get the bees from a frame of comb, first give the

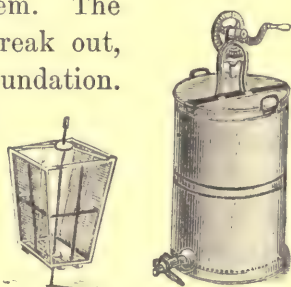


FIG. 29.

The honey extractor (Fig. 29) should be of metal, should run with gearing, should hold one or two hundred pounds of honey beneath the revolving frame which carries the combs, should

latter a quick, sharp jerk, then by use of Cook's brush, a pine twig, a bunch of asparagus, or a large feather, brush off the bees. If the honey is capped over, it must be uncapped. To do this we ought to have a knife (Fig. 31) with a beveled edge. Such knives are incomparably superior to others. While extracting through the season it is best to extract just before the bees

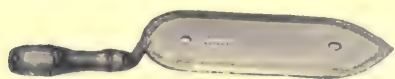


FIG. 31.—BINGHAM KNIFE.

cap the honey. This prevents the labor of uncapping, and if the honey is kept in a dry, warm room (and honey should never be kept

in any other) there will be no danger of fermentation. While extracting, if any of the combs have uncapped brood in them we must turn with a gentle motion, and some longer. This will extract all the honey, and disturb none of the larvæ.

After it is extracted, the honey should be kept in an open barrel or can, with a porous cloth spread over it. This secures the requisite evaporation, so that the honey "ripens" as thoroughly as if left in the hive till capped. In extracting in the fall, when gathering has ceased, the bee-tent already referred to is all-desirable.

HANDLING BEES.—The fear of bees, which deters so many from becoming bee-keepers, is entirely unnecessary. Unless the sting of bees is terribly poisonous, no one need hesitate for this reason. I have had classes for the past fifteen years ranging from fifteen to forty, and of the whole number only two would be interdicted from this cause. The sting from a bee also inoculates, so that the poison from each successive sting is less and less virulent.



FIG. 32.

Again, the young bee-keeper can so protect himself by veil, gloves—though these will soon be discarded as undesirable and clumsy—and bee-tent, already referred to, that stings will not be received at all. Soon, with experience, all dread or fear of this kind will wholly disappear. The best bee-veil (Fig. 32) is made by sewing black tarlatan to a common, cheap hat. The tarlatan should be strong. If gloves are used, rubber ones are best.

To smoke bees, which in nearly all cases will quiet them so they will not sting unless pinched, a "bellows smoker" (Fig. 33) is very desirable. To use these we blow a little smoke into the entrance of the hive, then take off the cover and smoke them thoroughly from above. This smoking causes the bees to fill with honey, in which state they are kind and amiable. The black and Italian bees are almost always easily subdued by smoke. The Cyprian and Syrian bees are sometimes uncontrollable by its use; for which reason the beginner better always

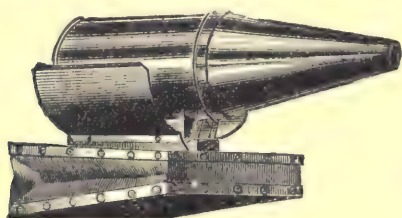


FIG. 33.

have Italian bees. To smoke bees, nothing is better for fuel than wood in the first stage of decay.

It is well known to all beekeepers that nothing irritates bees like quick motions; therefore in handling bees he who would not be stung must never strike at them, shake his head, or in any way act as if nervous. It is doubtless this—quick jerks or movements—which causes some to be stung so frequently, instead of any odor of perspiration.

In case bees attack one while he is unprotected, it is better to cover the face with the hands and quietly walk into the nearest room, or bury the head in thick grass or bushes. If horses are attacked they should be driven quickly into a barn, as bees are slow to enter a building. Ammonia is the best antidote for bee poison. If horses are badly stung, blankets wet in cold water should be spread over them.

COMB FOUNDATION.—This is made of bees-wax, and except for thickness, is nearly like the natural comb just as the bees commence to raise the cells, and is as acceptable to the bees. As foundation saves the bees the expensive work of secreting wax for comb, it pays an immense profit on its cost, besides securing beautiful, straight combs. Foundation (Fig. 34), to be of the best, must have a very thin base, and high, thick side walls which ought to be loosely pressed in the manufacture. There are two styles of foundation machines, the roller and the press. Both give excellent foundation, though the press alone

stamps the foundation right into the wired frames. To make foundation, wax sheets are first formed by dipping a board into melted wax, then into cold water. The sheets are then passed through between two stamped rollers, or pressed by use of the plates of the press, which opens like a book to receive the sheets.

It is best to use only worker foundation, and I should not wish it lighter than a pound to seven square feet, even when used in sections. Foundation can be used with great profit, either in the brood frames or sections. In the latter it is best held in by dipping the edge in melted wax to which a little resin has been added. It should be the size of the section, and ought to

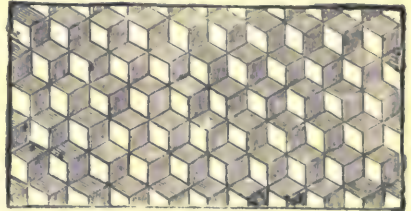


FIG. 34.—COMB FOUNDATION.

be fastened exactly in the middle of the top bar. In the brood frames the foundation may be fastened as suggested above, or it may be made to adhere by pressure, or best of all, it may be pressed into wired frames where it must be held true, can never warp or sag, or drop from the frame. If the foundation is pressed into wired frames when stamped, No. 36 tinned wire is used; if it is to be pressed in by hand, then No. 30 wire is best. In this case the foundation is



FIG. 35.

laid under the wires (Fig. 35), which are then pressed in by using a common button hook with a groove cut into the convex side of the hook.

SAVE THE WAX.—As foundation has become so important an article, wax is now in great demand. Every scrap should be saved. Whenever we see drone comb, with or without brood, it should be cut out and melted. Old combs, all pieces, and the cappings, after draining off the honey, should be similarly treated. To melt the wax, the comb may be placed in a bag and this in hot water, care being taken that the bag does not touch the bottom of the vessel holding the water, or it will be burned. A better way to save the wax is to use a regular wax

extractor (Fig. 36.) This consists of an inner perforated vessel, which rests in a steamer, which rests on a vessel containing water. By its use, we get our wax in nice condition with no trouble, and save it all. By letting the wax cool slowly all impurities settle.

MARKETING HONEY.—To secure the best price for our honey, it should be in clean sections or very neat vessels; should be in quantities from one pound, or even half pound, to two pounds;

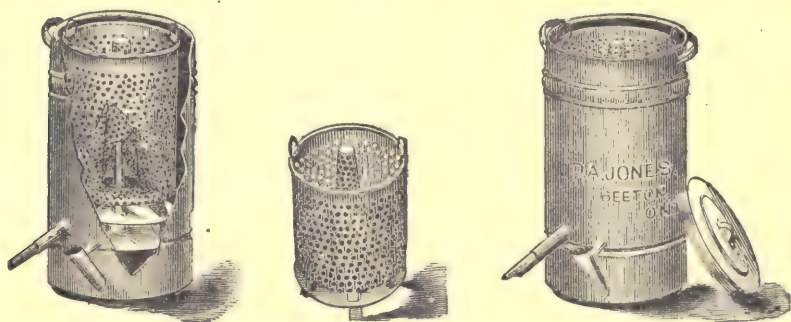


FIG. 36.—IN THREE PARTS.

should be thoroughly graded, and should bear the name of the producer on the showy label that is affixed to it.

Extracted honey should be put into neat pails with showy labels, or else into glass cans or bottles, as the market demands. The labels on vessels containing extracted honey should state that granulation is the best test of purity, and should state that mild heat would reliquefy with no loss of quality.

If all bee-keepers would follow the above directions, and would see to it that all groceries had at all times honey on hand for sale, there would be almost no limit to the amount of honey that could be sold, and at good prices.

HONEY PLANTS.—Though the principal part of the honey comes from bloom of plants, yet at times the bees get no small amount from insect secretions; from the juices of plants, and other glandular secretions than those of the flowers. In visiting flowers bees do great good in effecting fertilization, and never injury, as is sometimes affirmed by those who know nothing of the matter.

The principal honey plants are the willows and maples, only important as they come so early that they stimulate early breeding, the fruit bloom, white and alsike clover (Fig. 37), raspberry bloom, locust, melilot or sweet clover, the incomparable basswood (Fig. 38), and later the fall bloom, which includes buckwheat, asters (Fig. 39), golden-rods, bonesets, and many other composite plants which yield bountifully of rich golden honey. These are the standard honey plants which can be depended on, while there are many others which can be planted to supplement the ones mentioned above. Of these the mustards, rape, borage, catnip, motherwort, Rocky Mountain bee-plant, figwort, and spider-plant are the most valuable. These can be set out so as to furnish pasturage at any desired time.



FIG. 37.

It will pay well for bee-keepers to set out basswoods and locusts along the road-side, scatter figwort, Rocky Mountain bee-plant, catnip, and motherwort in all waste places, and by furnishing seed, if that be necessary, induce their neighbors to sow liberally with alsike clover. There is no question but that by taking heed to these suggestions the honey product can be much increased.

To close this subject, I must refer to the oft-repeated accu-

sation that bees destroy grapes. After great pains to learn the truth of this matter, I fully believe that bees never attack and destroy sound grapes. Let bird, wasp, or nature first perforate



FIG. 38.

the grape, then the bees are quick to find the oozing juice and suck it up. The great raids usually are made on tender-skinned grapes like the Dela-

wares, when they are very ripe, and at the time of a very warm, damp atmosphere. At such times the bees all at once, as if moved by a common impulse, swarm on the grapes, and soon rob them of their juice. Now no one who knows the habits of bees would or could believe that they fell all at once to eating the grapes; but let nature

once puncture the fruit so that the juice exudes, and then it would be exactly like bees to essay to prevent the waste. I have never seen it, but I believe in all such cases close observation would detect the punctures and the oozing drops.

WINTERING.—The knowledge to winter bees safely would be worth a great sum to bee-keepers. As often as once in two or three winters there is such a mortality among bees that serious loss and



FIG. 39.

discouragement confront the apiarist. Yet the fact that some of our number meet with no loss encourages us to believe that with more knowledge and care loss from this cause will be unknown. I have now wintered for several years in our cellar, a period covering two disastrous winters, with no loss. I have known of several similar cases.

To winter bees the most successfully, every winter they must be kept as inactive as possible. To secure this bees should be unmolested, should be kept in a uniform temperature of from 35° to 45° F. about the hives, should have thirty pounds of good capped stores, and should be kept all the time in a good, pure atmosphere. This last requires good ventilation. I think the presence of pollen in the hive will generally cause no harm, but sometimes it certainly brings disease and death; hence I would advise its preclusion, for the most part, from the hives in winter, especially as this causes little pains and trouble.

The uniform temperature would not be necessary if the bees could fly every week or two, so in the southern part of our country bees need no protection, as they invariably winter well on their summer stands; nor is pollen harmful in such a climate. In the North, during open winters, bees will winter well with no protection; but as the severe seasons come so frequently, it is never wise to neglect preparation for the most rigorous season.

To secure the uniform temperature some use chaff hives. These are simply double-walled hives, with a filling of dry sawdust or chaff. With this arrangement a four or six inch wall bounds the bees on every side and above and below. The opening for the bees to pass in and out exists in winter, so the bees can fly if the weather induces flight. The objections to such hives are—cost, weight, making them heavy and awkward to handle, and too frequent failure even in the hands of their best friends. Yet some of our ablest apiarists praise them as most desirable.

The other way to winter is in a thick-walled house, or, better, a cellar, where by proper ventilation the air can be kept sweet and wholesome all the time, and yet the temperature will remain invariable. The cellar is only better as the earth aids

us to maintain the desirable temperature. That such a room should always be just right, a tube the size of a small stove-pipe should run from near its bottom to connect with the pipe of a stove in the room above which is much used in winter. Another larger pipe of tile should run one or two hundred feet under ground below the influence of out-door temperature, connecting the bottom of the cellar with the outer air. Thus whenever a fire burns in the room above the air is drawn from the cellar, and its place taken by other air drawn through the long sub-earth pipe from out-doors. This tempers the temperature in rigorous winter, and cools it when the weather warms up in spring. The cellar should by all means be mouse-proof. I believe if bees are properly prepared they will always winter in such a cellar.

To prepare bees for winter they should be kept breeding till autumn by feeding if necessary; should be strong, which in case of nuclei and weak colonies necessitates uniting.

As soon as the honey season is over see that each colony has thirty pounds of good capped honey on just enough frames to comfortably contain them. I only use eight of the Gallup frames. Confine them by use of division boards. Cover above and at ends with thick, warm sacks of dry sawdust on chaff. I would preclude pollen as much as possible, and would cut a small hole through the center of each comb, so that the bees can pass from one comb to another without passing around. Close the entrance so that it is not more than an inch long, when if in chaff hives they are ready for winter. If to be put into the cellar leave them till just before cold weather comes, and then carefully remove to winter quarters. When in the cellar I remove the cover to the hive, but not the sawdust sack, and open the entrance wide. The cellar should be dark, for if not, and the bees become a little too warm, they will be attracted to the light and never again reach their hives. Most persons say that the cellar should be entirely dry. True, the atmosphere should be dry and sweet, but a stream of water passing through a cellar, or a cistern full of water is an advantage, as the latent heat in the water helps to preserve the uniformity of temper-

ature. Our cellar has a stream of water passing through it, and has been used with entire satisfaction.

If every thing is arranged as described above, the bees will continue quiet in the cellar from November till April. If, however, the bees become uneasy in winter, they need to empty their distended intestines, and should be carried from the cellar the first warm day suitable for a flight. After the cleansing flight they should be returned to the cellar. Cooling off the cellar or enlarging the opening of the hive will often quiet the bees. If the bees have not sufficient food for winter they should be fed good honey or syrup made of granulated sugar, which is equally good. If destitute of food in mid-winter, which ought never to occur, they should be fed common or the "Good candy."

SPRING DWINDLING.—By this is meant the dying off of the bees in spring. It is often the source of terrible loss. The cause is poor wintering, and few and feeble bees in spring. The remedy is care to winter well, protection from cold in spring, and crowding by use of the division board, so that the bees shall have only so many frames as they can cover. I have never lost a colony by this malady. I think I have escaped by crowding the brood-chamber and by use of warm covering.

DISEASES OF BEES.—Common "Dysentery," caused by unfavorable wintering, arises from improper food or too changeable temperature. Care to observe the rules already given as to wintering will prevent this dreaded malady.

"Foul Brood," the terrible scourge of the apiarist, is a fungoid disease, the germs of which are contained in the honey of all the diseased colonies, and so are easily carried to other colonies; thus the disease is as contagious as it is deadly. In this disease the mature bees are not affected, but the brood becomes rotten. The symptoms are terrible stench from the decaying brood; rotting brood, which if pulled from the hive, comes out as a brown, stringy mass. Concave caps to the cells containing the rotting brood, and often a small hole through the center of these caps. The best remedy for the most of us to practice is to bury or burn all affected colonies as soon as the disease is discovered. Two remedies, one by salicylic acid, the other by

making the bees to fast, are fully described in my Bee-keeper's Guide or Manual of the Apiary.

ENEMIES OF BEES.—The bee moth is generally thought the worst enemy. This, however, only successfully attacks weak or queenless colonies, and is no dread to the wise and cautious apiarist. If the bee moth trouble us we should the better learn our business. If combs contain not too many larvæ of the moth, by giving one each to good, vigorous colonies, we may soon rid our combs of them. Extra combs should be kept in close boxes, so that no eggs can be laid on them.

Wasps, ants, cow-killers, robber flies, tachina flies, bee lice, the stinging bug, spiders, and mites also disturb bees. These are fully described in my work on bees. Toads often eat bees, but they can be easily fenced out if their mischief is disturbing. The king bird eats worker as well as drone bees; but this bird is a good friend of the farmer, as a feeder on injurious insects, and we should be slow to pronounce the death warrant against it. Mice and shrews are serious pests if they gain entrance to the hives in winter. By lessening the size of the entrance, or putting a screen of perforated zinc before it, or, better, having mouse-proof cellars, these vermin can be kept at bay.

CHAPTER XXI.

THE CHEMISTRY OF FOODS AND FEEDING.*

IN order to understand this subject so as to make it of practical value, a little knowledge of the composition of the animal body and the laws of nutrition is necessary.

The carcass of a fat ox, exclusive of offal, contains in every one hundred pounds about fifty-six pounds of water. A lean animal contains a much larger percentage of water. The remainder of the body is composed of three principal substances: muscle and similar matter, fat, and bones. The dry substance of muscle contains about fifteen per cent of nitrogen, and is hence called nitrogenous matter; fat contains no nitrogen; and the bones are composed of phosphate of lime, in connection with a nitrogenous substance called gelatine.

The animal lives, grows, and gets all its powers and faculties from the food it consumes, and its tissues are built up wholly out of the material contained in the food; and it is, therefore, necessary that the food should contain all the substances which are to be contained in the animal body. The animal can rearrange these substances, but has no power to create any thing not contained in the food.

Starch, sugar, and the other vegetable substances commonly described as carbohydrates, are composed of three elements: carbon, hydrogen, and oxygen. Fat is composed of these same three, only arranged in a little different proportion; muscle consists of these three elements, and also of nitrogen. An animal, therefore, can transform starch or fat into fat, but can not convert them into muscle, as that contains a substance which neither of the other materials can supply.

* By R. S. THOMPSON.

Foods.—Vegetable foods, which are what we have to do with in feeding animals, are composed of five principal substances, which resemble the four chief constituents of the animal. These are: Water; Carbohydrates, substances of the nature of starch and sugar, which contain no nitrogen; Fats, composed of the same elements as carbohydrates, but containing a larger proportion of carbon; Albuminoids, substances composed of carbon, hydrogen, oxygen, and nitrogen, and nearly identical in composition with the nitrogenous matter of the animal body; Ash, that which remains when a plant is burned. It contains phosphate of lime in considerable proportion, and supplies the material for the formation of bones.

We thus see that the plant is exactly fitted for the support of animal life. A more detailed description of the composition of various foods will be given later in this chapter.

Use of Food.—Food in the animal body is used for six different purposes: 1. The repair of waste; 2. Growth; 3. Production of milk; 4. Production of fat; 5. Maintaining animal heat; 6. Supplying energy.

The body is constantly undergoing waste. The substance wears out, breaks down, is taken up by the blood, and removed by the excretory organs—namely, kidneys, lungs, and skin. The matter thus removed must be as constantly replaced, or the animal will grow thin, and ultimately die. To supply material for repairing this waste is the first use of food.

When an undeveloped animal is given more food than is required for repair of waste and for supplying heat and energy, the additional material is used for the production of more tissue, and the animal grows. If no more food is supplied than is required for the first, fifth, and sixth uses, the animal can not grow, but becomes stunted.

When a mature animal is supplied with more food than is required for repair of waste and production of heat and energy, the surplus material is converted into fat. It is much more difficult to make a young animal lay on fat than a mature one; for if the food is of the right character it will use the surplus in growth, rather than in production of fat.

The greater portion of the food consumed by the animal is used for the last two purposes named, the production of heat and energy. The food, after being digested, is taken into the blood, and carried through the system; the blood, while passing through the lungs, absorbs oxygen from the air, and this combines with part of the food in the blood. This combination is exactly the same in character with that which takes place when a substance is burned, and consequently it is often said that the food is "burned in the blood."

By this process the heat of the body is maintained, and the energy required to keep up the vital process and enable the animal to move about is supplied. For this purpose all the principal constituents of food—albuminoids, carbohydrates, and fat—can be used, but are not of equal value, fat being worth about two and one-half times as much as carbohydrates, and more than twice as much as albuminoids.

Use of Different Food Constituents.—Albuminoids are capable of meeting all the requirements of the animal system. They can be changed into muscle, and so provide for repair of waste and for growth; they can also be converted into fat, and can be burned in the system for production of heat and energy. When used for other purposes than the production of muscle, the nitrogen they contain is separated in the form of a compound called urea, and removed from the system through the kidneys.

Carbohydrates and fats are capable of being converted into fat, and of being burned in the system for production of heat and energy, but they can not be used for repair of waste or for growth.

From what has already been stated, it will be seen that it is impossible to make any absolute standard of valuation for the different constituents of food. The albuminoids possess a special value, because for a certain purpose no other food constituent can replace them. If an animal is not supplied with sufficient albuminoids the deficiency can not be made up by increasing the supply of carbohydrates and fats. But if a food contains sufficient albuminoids to meet the needs of the system

then for other purposes, they are but little superior to carbohydrates, and far inferior to fat.

Different Foods.—We are now prepared to consider the composition of different articles of food. It has been shown that the chief constituents of all foods are: Albuminoids, or substances containing nitrogen; carbohydrates, substances such as starch, sugar, etc., containing no nitrogen; fat, resembling carbohydrates, but richer in carbon; ash.

The nitrogen in foods is not always in the form of albuminoids, but is sometimes contained in a class of substances called by chemists amides. So little is yet known about these substances that in this chapter we shall not attempt to make the distinction between amides and true albuminoids, but shall class all nitrogenous matter as albuminoids. Amides, however, have not the feeding value of the true albuminoids, and in estimating the value of foods it should be remembered that in rich foods, such as grains, oil cake, etc., nearly all the nitrogen is in the form of albuminoids, while in poor foods, such as straw and roots, a considerable portion of the nitrogen—sometimes as much as half—is in the form of amides. In immature plants the amount of amides is usually considerably greater than in those more mature. The difference in value of rich and poor foods is, for this reason, usually considerably greater than the tables of analysis show.

Carbohydrates are usually divided into “soluble carbohydrates” and “crude fiber;” they are of the same character and composition, but the soluble carbohydrates are more digestible, and therefore more valuable than crude fiber.

Many writers in speaking of food constituents designate the albuminoids as “flesh formers,” and carbohydrates and fat as “heat producers.” From what has been already shown it is evident that this is not strictly correct, as albuminoids are capable of being used for the production of heat, and carbohydrates and fat, while not convertible into muscle, are convertible into fat.

All foods contain some water; even those usually called dry, such as hay, straw, and grains, contain from ten to fifteen per cent

of water, which can only be removed by exposing them to a heat equal to that of boiling water. Potatoes, which are the driest of the roots, contain seventy-five per cent of water, while turnips and beets are often ninety per cent water. The following table gives the number of pounds of water nitrogenous matter, soluble carbohydrates, fat, and crude fiber contained in one ton of each of the principal foods:

POUNDS OF EACH CONSTITUENT IN ONE TON OF VARIOUS FOODS.

NAME OF FOOD.	Water.....	Nitrogenous Matter.....	Fats	Soluble Carbohydrates	Crude Fiber.
GRAINS, CAKES, ETC.					
Cotton cake, decorticated,	200	824	280	360	180
Cotton cake, undecorticated,	230	492	124	604	416
Linseed cake,	240	562	240	606	220
Beans,	290	510	32	918	188
Peas,	286	448	40	1050	128
Oats,	260	258	120	1076	216
Wheat,	288	226	30	1362	60
Barley,	280	212	40	1274	142
Rye,	286	220	40	1384	70
Indian corn,	228	208	102	1370	60
Wheat bran,	280	284	84	1008	222
Corn cobs,	206	28	28	880	756
HAY AND STRAW.					
Meadow hay,	286	194	50	820	526
Clover hay,	320	246	44	764	520
Lucerne hay, cut in bloom,	334	288	50	450	800
Wheat straw,	286	60	30	652	880
Oat straw,	286	50	40	764	800
Corn fodder,	280	60	22	780	800
GREEN FODDER.					
Meadow grass,	1600	70	16	384	90
Clover,	1660	66	14	140	90
Rye,	1458	66	18	298	146
Lucerne, in blossom,	1480	90	14	140	250
Peas,	1630	64	12	164	112
Hungarian grass in blossom,	1312	118	30	300	230
Sorghum,	1480	50	28	306	146
Indian corn,	1644	22	10	218	94
ROOTS, ETC.					
Potatoes,	1500	42	6	410	22
Mangel wurzel,	1770	24	2	164	20
Turnips,	1834	22	4	106	20
Pumpkins,	1890	26	2	56	20
Sugar beets, small,	1630	20	2	308	26
Carrots,	1700	30	4	216	34

Such a table as this can only give averages. The same food will vary in composition according to the soil on which it was grown, the season, and the manner in which it was handled.

The composition of hay varies greatly with the date of cutting. The following table gives the number of pounds of nutritive substances contained in a ton of hay cut at three different dates :

NUTRITIVE SUBSTANCES IN HAY.	MAY 14.	JUNE 9.	JUNE 26.
Nitrogenous matter,	303	191	145
Fat,	55	47	46
Soluble Carbohydrates,	700	742	734
Crude Fiber,	394	598	654

The first date represents grass rather younger than would usually be cut for hay, but such as cattle get on a good pasture in spring; the second date represents good, early cut hay; the third, that which has been cut late, and is rather coarse and stemmy. It will be noticed that as the season grew later there was a remarkable decrease in the amount of nitrogenous matter and a remarkable increase in the crude fiber. Crops that have been grown on highly manured land usually contain more nitrogenous matter than those grown on poor soil. Root crops that have been grown on poor, dry soil, are more nutritious than those grown on rich soil, as they contain less water. Root crops increase in nutritious qualities as they become more mature, as a portion of fiber contained in the immature root is converted into starch and sugar. For the same reason they are more valuable later in the winter, if properly kept, than just after they are harvested. Clover is very liable to lose nutriment in curing. The greater part of the albuminoids which render it so valuable, are contained in the leaves, and if it is handled and cured in such a manner that a considerable portion of these are broken off and lost, its feeding value will be greatly diminished. Hay, if exposed to drenching rains after curing, loses a large portion of its most digestible constituents by leaching, and if fermentation takes place to any considerable extent, a great loss of valuable constituents will result.

Digestibility of Foods.—The analysis of a food does not by itself determine its feeding value. A food may contain all the material needed for the support of life, in abundance, yet if the animal can but partially digest it, much of the nutriment

it contains will be wasted. Failure to appreciate this fact has in many cases brought discredit on chemical analysis as a means of determining the feeding value of foods. A comparatively poor food, if all digested, may be of more real value than a very rich one, of which a large portion is indigestible.

No table of the digestibility of food could be prepared which would be absolutely and always correct. The same article will differ in digestibility according to soil, season, and manner of curing. Different classes of animals have different powers of digestion, and no two animals, even of the same kind, are exactly alike in this respect. Tables of digestibility, therefore, can only be approximate, and must be used as guides, not as absolute rules.

The following table gives the number of pounds of digestible constituents in a ton of various foods, as determined by taking the average of a large number of experiments with cattle and sheep. It will be noticed that in many respects it differs very materially from the preceding table:

NAME OF FOOD.	NITROGENOUS MATTER.	FAT.	SOLUBLE CAR- BOHYDRATES.	FIBER.
Linseed cake,	472	216	473	?
Beans,	449	30	854	?
Oats,	204	101	818	52
Barley,	163	40	1108	?
Indian corn,	164	87	1247	?
Wheat bran,	213	42	706	82
Meadow hay,	109	23	508	300
Clover hay,	135	25	527	229
Lucerne hay,	219	19	301	320
Oat straw,	19	12	329	488
Wheat straw,	12	11	254	494

Horses have not as much power in digesting coarse food as cattle and sheep, but for concentrated food their digestive powers are about equal. Swine have great digestive powers on concentrated foods, and can digest well a reasonable amount of green foods, but have not the stomach-room to take and digest large quantities of coarse food, like cattle and sheep.

The degree of maturity of some crops has great influence on their digestibility. Young grass is much more digestible than

that which is nearer ripe. The following table gives the number of pounds of *digestible* constituents contained in a ton of hay cut at three different periods :

	MAY 14.	JUNE 9.	JUNE 26.
Nitrogenous matter,	222	138	80
Fat,	36	24	20
Soluble carbohydrates,	530	459	414
Crude fiber,	313	393	400

It will be noticed that this is the same experiment which we recently referred to, but the difference in value of the young and old grass is now seen to be much greater than was shown before. Not only does the young grass contain a much larger amount of valuable substances than that which is older, but a larger portion of what it does contain is digested. A cow would have to eat about fifty-five pounds of hay, made the latter part of June, to get as much digestible albuminoids as she would get in eating twenty pounds of hay made in May.

This fact explains in a measure the great value of young pasture. Stock not only like it better and so eat more of it, but that which they eat is more digestible and contains a larger proportion of albuminoids. When pasture gets old cattle can not eat a sufficient quantity of it to supply the needed material. One of the advantages of ensilage is that it enables the farmer to preserve his green fodder at the season when it is at its best, both as regards character and digestibility.

The digestibility of food is influenced somewhat by the proportion which the albuminoids bear to the carbohydrates. If the albuminoids are deficient in a food neither the albuminoids nor the carbohydrates it contains will be as completely digested as if more albuminoids were present. When a food is deficient in albuminoids its digestibility will be increased by feeding it in connection with some food which is rich in these substances.

Albuminoid Ratio.—This is a term which will often be met with in scientific works on feeding, and is not as difficult to understand as is commonly supposed. It simply means the proportion which the albuminoids in a food bear to the non-nitro-

genous constituents; namely, carbohydrates and fat. As fat, however, is a much more concentrated food than carbohydrates, it is customary to reckon each pound of fat as equal to two and a half pounds of carbohydrates.

To illustrate. Suppose that a given quantity of a certain food contained one pound of albuminoids and seven pounds of carbohydrates, we would then say that its albuminoid ratio was one to seven, usually written thus: 1 : 7, by which would be meant that for every pound of albuminoids in the food there was seven pounds of carbohydrates. But suppose the food contained to each pound of albuminoids four and a half pounds of carbohydrates and one pound of fat. Its ratio would then still be 1 : 7, as the one pound of fat would be equal to two and a half pounds of carbohydrates, which, added to the four and a half pounds of carbohydrates, would be equal to seven.

Strictly speaking, a pound of fat is only equal to two and forty-four one hundredths pounds of carbohydrates, but in practice the proportion of one to two and a half is used, as being more convenient and sufficiently near the truth.

A food is said to have a high albuminoid ratio when the albuminoids are in large proportion, and low when the reverse is the case. Thus cotton cake has the high albuminoid ratio of 1 : 1½, while wheat straw has the low ratio of 1 : 64½.

The following table gives the albuminoid ratio of the leading articles of food, calculated from the digestible portion of the food only :

Cotton cake decorticated,	1 : 1.5
Cotton cake undecorticated,	1 : 1.8
Linseedcake,	1 : 2.3
Beans,	1 : 2.4
Peas,	1 : 2.9
Wheat bran,	1 : 4.2
Oats,	1 : 5.5
Barley,	1 : 7.6
Indian corn,	1 : 9
Clover hay,	1 : 5.9
Meadow hay,	1 : 8
Turnips,	1 : 6.2
Mangels,	1 : 8
Potatoes,	1 : 10.6
Wheat straw,	1 : 64.4

This table is calculated on the supposition that all the nitrogenous matter in the food is in the form of albuminoids, which we have seen is never strictly the case, and the true albuminoid ratio is therefore always rather lower than is here indicated. With the rich foods, such as grains and cakes, this difference is small, but with the poorer foods, such as roots and straw, the difference is quite considerable. For example, the ratio of mangels is given as 1:8, while the real ratio, calculating only the nitrogen contained in true albuminoids, is only 1:32. Unfortunately experiments have not yet been pushed far enough to make it possible to construct a complete table of ratios calculated from the true albuminoids only.

Influence of Water in Foods.—A certain amount of water is necessary to the life of the animal, but if an excess is contained in the food waste will be occasioned, as the water must all be warmed to the temperature of the animal, and a part must be evaporated through the skin. Considerable food must be burned to produce the heat thus required.

The proper proportion of water is—for sheep, about two parts to one of dry substance; for cattle, four parts to one. Cows giving milk require a still larger proportion of water.

In feeding grains and dry fodder there is little probability of supplying too much water, but in feeding roots alone the quantity of water is liable to be greatly in excess of the animal's requirements. When an animal is fed exclusively on turnips, a large part of the dry substance consumed will be used in raising the temperature and evaporating the surplus water.

Hence, roots should usually be fed in connection with dry food, and when fed in this manner will give much better results than when fed alone.

Feeding.—We have seen that food received by the animal is used for six different purposes: 1. Repair of waste; 2. Production of heat; 3. Production of energy; 4. Growth; 5. Production of fat; 6. Production of milk. The food given will be used for the first three purposes, and only the surplus beyond what is required for these will be applied to the last three. This rule is practically correct, yet in strict exactness there are

some slight variations. If a cow giving milk is supplied with only the exact amount of food required to meet the first three requirements, she will still give some milk, which will be produced from food which should have been used for repairing waste, and the cow will grow thin in consequence. But as far as practical profitable results are concerned the rule as laid down may be considered correct.

The food required for repair of waste and production of heat and energy is commonly called "food of support;" it is what keeps the animal alive. Except in the case of the working animal, it pays no profit to the feeder; it is the necessary expense of keeping the animal. Under all circumstances a large proportion of the food consumed by the animal must be used in this manner, but to secure profit in feeding it is essential that this proportion shall be as small as possible.

If a farmer feeds three tons of hay, all of which is used by the animals to which it is given as food of support, he will make no profit on it, and get no return for the hay. If he feeds three tons, and two tons are used as food of support and one ton for growth or production of fat or milk, he gets returns for one ton, and the other two tons are the cost of turning one ton into meat or milk. If only one ton is used for food of support, and two tons for growth or production of fat or milk, then he gets two tons converted into profitable forms at the expense of one ton.

There are two ways in which we may diminish the proportion which the food of support bears to the total amount supplied. To secure profitable feeding, both these plans must be used. The first is—

Reducing the Food of Support.—We have seen that the food of support is used for repairing waste and production of heat and energy. The amount used for the first purpose is small. A half pound of digestible albuminoids, which would be contained in two pounds of beans or five pounds of oats, will repair the necessary waste of substance during twenty-four hours on an ox weighing one thousand pounds.

The largest part of the food of support is expended in the production of heat and energy. In order that the animal may

live, it is necessary that its body must be kept at a temperature of about one hundred degrees. This temperature must be maintained, if the animal is to live, no matter how cold the weather. The heat necessary is obtained, as we have seen, by the consumption of food, and the food used for this purpose can not be used for any other. A man might as well expect to enlarge his house with wood he had to burn to keep it warm as to expect to fatten an ox with food it has to use to keep itself warm. It is evident, therefore, that one way in which the amount of food required as food of support may be reduced, is to protect the animals from exposure to cold.

When labor of any kind is performed by an animal, food must be burned in the system to develop the needed energy. All the processes of life—digestion, assimilation, thought—require energy which must be developed from food. Excitement of any kind involves an expenditure of energy, which must be developed from food. Every one knows that the power in an engine comes from the wood or coal that is burned, and that the more energy required the more fuel must be burned. Every engineer knows that any unnecessary friction about his engine (a journal that does not work smoothly), will cause an increase in the amount of coal that must be burned. The animal gets its power from the food, as the engine gets its power from the fuel; and every increased expenditure of energy, whether physical, mental, vital, or nervous, involves an increased consumption of food for this purpose. It is evident that in order to reduce the amount of food consumed for this purpose that animals being fed for production of meat or milk should be required to make no exertion not absolutely necessary. Cows should not be compelled to go far in quest of water, or be compelled to roam over a ten-acre field to gather the food they should be able to get on a quarter-acre.

We have seen that not only physical energy, but also that by which the vital processes, such as digestion and assimilation, are carried on, is obtained from the food; and we can, therefore, reduce the amount of food of support by providing food which is easily digested. This fact probably explains some of

the claims made for ensilage. It has been said that a pound of digestible albuminoids, or any other food constituent, is just as valuable in dried fodder as in that which is green, and it is true in a sense; but if the dried fodder is more difficult of digestion, then a portion of the food digested, which in case of the green fodder would be used in the production of meat and milk, will be consumed in the production of energy, to overcome this difficulty of digestion.

We have seen that nervous energy is obtained from the food. Hence, if an animal is kept in terror or excitement, teased or annoyed by dogs or flies, or caused to fret in any way, there will be an extra amount of the food used in development of this energy, which otherwise might go for the production of meat or milk.

In order, then, to reduce to the lowest point the amount of food used as food of support, we get the following rules:

The animal must be protected from the cold.

It must be called on to make no unnecessary physical exertion.

It must be kept in a placid, happy temper, free from all annoyance, excitement, or alarm.

The food it receives must be easy of digestion.

By these means the amount of food used as food of support will be decreased, and the proportion which the food of support bears to the total amount of food supplied will be decreased.

The second method of decreasing the proportion which the food of support bears to the total amount of food supplied, is by

Increasing the Amount of Food Supplied.—Suppose that under certain conditions a cow required fifteen pounds of hay daily, as food of support; the proportion, then, between the food of support and total amount supplied would be 15 to 15. If twenty pounds of hay were given, the proportion would be 15 to 20; if thirty pounds were given, it would be 15 to 30; if forty pounds were given it would be 15 to 40; and so on up to the limit of the cow's capacity. It is thus evident that every increase in the total amount of food supplied causes a decrease in the proportion which the food of support bears to the total amount of food supplied.

The above calculation is not strictly accurate, for the reason that the increase in quantity of food supplied would cause an increase in the amount which must be consumed for the production of digestive energy; but it is sufficiently near the truth to demonstrate the principle, and to show that, to secure the best results in feeding, not only must the food of support be reduced to the lowest point, but the food supplied must be increased to the highest point.

The total amount of food that can be supplied to an animal is limited by that animal's power to eat and digest it. If the food is coarse and bulky, requiring a large quantity of food to contain a small amount of nutriment, the animal can not take a sufficient quantity to accomplish the best results. If the food is distasteful to the animal it will not take enough to accomplish the best results.

Therefore, to secure such an increase in the quantity of food taken by the animal as will secure the largest proportion of food of profit compared with the food of support, the animal must be liberally fed; the food must be in as concentrated a form as is consistent with the health of the animal; the food must be agreeable to the animal, so as to cause it to desire to eat all that it can.

Proper Adjustment of Food.—There has been a popular and a supposed-to-be scientific idea that food was valuable in exact proportion to the amount of nitrogenous matters it contains. This is only partially true.

A certain amount of nitrogenous matter is essential in a food, and, if it does not contain this, the excess of carbonaceous matter will be wasted, To illustrate: Suppose a pig requires a diet with an albuminoid ratio of 1 to 7; that is, containing one pound of albuminoids to every seven pounds of carbohydrates, or their equivalents in fat; and suppose this pig is supplied with food containing but one pound of albuminoids to every fourteen pounds of carbohydrates. The extra seven pounds of carbohydrates will be rejected, and the pig will get no more benefit from the one pound of albuminoids and fourteen pounds of carbohydrates than he would have obtained from one pound

of albuminoids and seven pounds of carbohydrates. More than this, as the pig's capacity of food is limited, he will be prevented in the second case from taking the amount of available nutrient essential to the most profitable results.

On the other hand, if the pig is given a diet of two pounds of albuminoids to six pounds carbohydrates he will get no more benefit than from one pound albuminoids and seven pounds carbohydrates. We see from this that up to the point when the correct albuminoid ratio is reached the value of the food is in direct proportion to the amount of albuminoids it contains, but after this point is attained there is no special gain in an increase in the proportion of albuminoids. Inasmuch as nitrogenous material in food is generally more expensive than the other constituents it is desirable, in order to secure the greatest profit in feeding to know what is the correct ratio, and secure food that comes as near to this as possible, in order to avoid waste on the one hand, or the use of unduly expensive food on the other.

Ratio for Young Animals.—The object in feeding these is to secure growth, development of bone and muscle, rather than fat. The food, therefore, should be rich in albuminoids, and experiments have shown that while the animal is making its growth the correct ratio for the entire food is about 1:5, calculating all the nitrogenous matter in the food as albuminoids. Oats, clover, bran, and young grass are eminently fitted for the use of the young animal. When hay, straw, or other foods, in which the ratio is considerably below this have to be used as a portion of the diet it will often be profitable to use in connection with it some food rich in albuminoids, such as linseed cake.

The young animal must, however, have an abundant supply of food for the maintenance of animal heat and supply of energy; and to obtain this wholly from coarse food such, as straw or poor hay, would require the consumption of too large a bulk of food. Fat supplies this kind of material in its most concentrated form, and therefore foods containing, in connection with a good supply of albuminoids, plenty of fat, are well adapted for the young animal.

In milk, the food naturally provided for the young, we find just this combination, as it is rich in albuminoids and fats, and the carbohydrate it contains, sugar, is exceedingly digestible. Skimmed milk fed in connection with old process linseed cake, to make up for the fat removed, fed in connection with young grass or clover hay, makes a ration which is scientifically correct and practically successful.

If the albuminoids are deficient in the diet of a young animal, it will be apt to cause it to lay on fat prematurely. When the natural work of developing bone and muscle is thus changed into one of fat production its health is impaired, it becomes stunted and "pot-bellied," and never will attain its proper size.

Ratio for Milk.—The cow can manufacture milk only out of the food given her. If this food is in sufficient quantity, and contains all the elements contained in the milk, the cow, if naturally fitted for milk production, can yield milk, liberally, but no care in breeding or perfection of pedigree will enable her to put into the pail material which she does not find in the food. The average composition of cow's milk is as follows :

Water,	. . . . .	870
Albuminoids,	. . . . .	40
Fat,	. . . . .	37
Sugar,	. . . . .	46
Ash,	. . . . .	7
		<hr/>
		1,000

The albuminoids in the milk must be formed from the albuminoids in the food ; the fat and sugar from either albuminoids, carbohydrates, or fat, usually the two latter. The ash is chiefly phosphoric acid.

The great requirement, therefore, in a diet for milk production is a sufficiency of albuminoids. The ratio should be about 1:5. Good young meadow grass has a ratio of about 1:4. This explains why cows do so well on the early pasture. Later in the season the albuminoid ratio of grass falls, and old stemmy grass in July often has a ratio of less than 1:10. Every farmer is familiar with the fact that cows on pasture usually

fall off in their milk as the season advances. This is not merely due to deficiency in the quantity of food, but to its inferior quality. It would take at least one hundred pounds of grass, such as is often found on summer pastures, to furnish the albuminoids contained in twenty-five pounds of milk. To expect a cow to give milk liberally on such a diet is manifestly an absurdity.

Feeding corn-meal to the cow when the pasture begins to fail will not make up for the deficiency in albuminoids, as corn is itself deficient in this respect. The corn-meal will enable the cow to do *better*, as, being a more concentrated food, she will be able to eat a larger quantity, but it will not enable her to do what she could were her diet properly proportioned. Bran is good for this purpose, as is also clover, and when a cow can be supplied in summer with a pasture of mixed grasses and clover, she is given a diet suited to the end to be attained, and if a little bran or linseed cake is given in addition the result will be still better.

In winter a good albuminoid ratio for milk production can be obtained from clover hay, fed in connection with corn-meal, or from meadow hay, straw or corn fodder, fed in connection with bran. Where ensilage is used, red clover, ensilaged when in bloom, fed in connection with corn fodder, either cured or ensilaged, makes a good ration.

Fattening Animals.—Fat, we have seen, can be produced as well from carbohydrates or fats in the food as from albuminoids, and the diet for a fattening animal, therefore, need contain no more albuminoids than is required for the repair of waste and the production of so much lean meat and tissue as must always accompany the production of fat. The diet for this purpose must, therefore, be rich in carbohydrates, and especially in fats. It must also be in a sufficiently concentrated form to enable the animal to take a large enough quantity. As has been before shown in this chapter, it is to the interest of the farmer, when fattening an animal, to get it to eat as much as possible without deranging its digestion. Straw, if fed in connection with a little clover, bran, or oil cake to bring up its albuminoid ratio, would not be a bad diet for fattening could

the animal eat a sufficient quantity of it. The great value of corn as a fat producing food does not depend merely on the fact that it is so rich in carbohydrates and fat, but also in the fact that it is condensed so that the animal can eat a large quantity of it. Ten pounds of corn is equal to about twenty-two pounds of good hay, and its bulk is very much smaller.

The correct albuminoid ratio for production of fat varies with the animal. For fattening full-grown cattle a ratio of 1 : 9 is sufficient. Even a lower ratio would do were it not for the fact that when the ratio falls below this the digestibility of the food is impaired. For fattening immature animals which are growing while taking on fat it is evident a higher ratio will be needed, and one of 1 : 7 will be about correct. This ratio can be obtained by the use of young grass or clover, either fresh or ensilaged, clover hay, or meadow hay fed in connection with bran or oil meal. When corn is used for fattening young stock some food with a higher albuminoid ratio should be used in connection with it, and clover, young grass, or oil meal will answer a good purpose.

Hogs require a higher albuminoid ratio in a fattening diet than any other animal, and when growing pigs are to be pushed and fattened as they grow a ratio of 1 : 5 is desirable. In this country where beans and peas are so little used as food for stock this high ratio can be obtained by feeding skim milk in connection with corn. When milk is not obtainable, the food may be improved by feeding green clover in connection with corn. Corn alone is not a complete diet for the hog at any stage of his growth, and even when mature hogs are fattened on an exclusive corn diet loss is incurred. If one hog is fed on corn alone, and another on corn and skim milk—supposing them to have equal capacity as feeders—the latter will make more pork out of the corn he receives than the former.

In some English and American experiments in feeding swine the English experimenters obtained an increase of one hundred pounds of live weight for every four hundred and sixty-nine pounds of food consumed, while the American secured one hundred pounds of increase to every five hundred and thirty-three

The increase in the amount of food required to make one hundred pounds increase in live weight would probably not have been so great had the pigs been fed on a more suitable diet. The constant corn-feeding doubtless impaired their assimilative powers. But in another experiment with calves fed on skim milk the same principle was demonstrated. They were fed for ten weeks, and the number of pounds of skim milk required to make an increase of one hundred pounds live weight is shown in the following table :

	Pounds skim milk required to make 100 pounds increase in live weight.
First week,	1,102
Second week,	1,218
Third week,	1,317
Fourth week,	1,340
Fifth week,	1,460
Sixth week,	1,505
Seventh week,	1,671
Eighth week,	1,680
Ninth week,	1,701
Tenth week,	1,608

In this case also the increase in the amount of food required to make a given increase in live weight, or the decrease in the amount of growth produced from a given amount of food supplied is very marked, and the rule holds good in almost every case. The young animal assimilates a larger proportion of the food supplied, and uses less for the repair of waste and carrying on the vital functions.

The case is similar with fattening animals. As the period of fattening approaches completion the amount of food required to produce a pound of gain in live weight continually increases. The following table gives the result of an experiment with sixteen pigs which were fed ten weeks and weighed at the end of every two weeks; their average weight at the commencement of the experiment was 135.8 pounds, and at its close 276.3 pounds. They were fed on barley and pea meal :

	Pounds of food required to make 100 pounds increase in live weight.
First two weeks,	386
Second two weeks,	388
Third two weeks,	500
Fourth two weeks,	511
Fifth two weeks,	618

In this experiment it cost sixty per cent more to make a pound of pork in the last two weeks than in the first period.

Profitable Feeding.—To feed profitably it is necessary that the feeder should get the largest possible return from a given amount of food. It is not enough that the animal shall be made to grow or get fat or give milk, but this must be done with the smallest possible expenditure of food, and to understand how to do this constitutes the science of profitable feeding.

Two farmers may be engaged in raising cattle; they may have equally good stock; they may show equally heavy weights at the butcher's block, and take equal premiums at fairs, but if one farmer accomplish these results with less expenditure for food than the other it is evident that he will make the greater profit.

To attain this greater profit it is essential that the largest possible proportion of the food used shall be converted into growth, milk, or fat, and the smallest possible proportion be expended in production of heat and energy—that the least possible proportion shall be rejected by the animal unused, and at the same time that the food used shall not be more expensive than is necessary for the attainment of these results. To do this, attention must be given to *all* the various points heretofore laid down.

The first requisite is a good breed of stock, animals that inherit large digestive and assimilative powers, and quiet and gentle dispositions.

Second. Protection from cold. The animal heat must be maintained, and food used for this purpose can not be used for any other. Locomotive boilers are covered with a good, warm coat of non-conducting material, and this, with polished sheet-iron to avoid all waste of heat, as waste of heat means waste of coal. Waste of heat in the animal means waste of food, and just as more coal will be required to accomplish the same results with a locomotive if the boiler is exposed without protection to the blasts of winter, so more food will be required by the animal if it is likewise exposed. And this food brings no profit; it is simply wasted.

Third. The animal must be spared all unnecessary exertion and excitement. Every movement, every excitement, consumes food which brings no profit.

Fourth. The food must contain a sufficient proportion of albuminoids for the purpose intended. If these are deficient, the other constituents of the food will be wasted. What is the correct proportion for different purposes has been already given.

Fifth. The animal must have all the food it can eat and digest, in order to secure the largest amount of food of profit above the food of support.

Sixth. The food must be sufficiently concentrated to enable the animal to consume the required amount.

Seventh. The feeding must be done at that period in the age of the animal when it is capable of giving the largest returns, namely in youth.

To these might be added that the food must be easy of digestion, calculated to promote the animal's health, and agreeable in flavor, so as to provoke its appetite.

CHAPTER XXII.

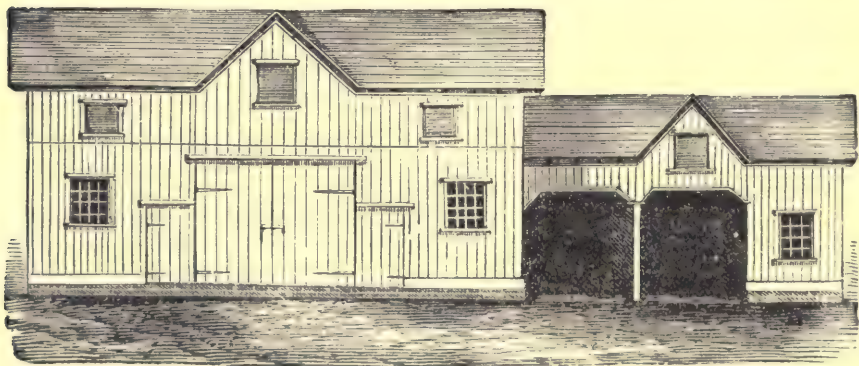
THE BARN AND BARN-YARD.

IN a large area of our country, due regard for the comfort of our cattle, and for the condition of the farm, requires that for nearly half the year our stock should be kept in the barn or barn-yard. As our system of farming improves we must abandon the wasteful and slovenly method of allowing the cattle to roam over the farm during the storms and mud of winter, getting only a starvation diet, while wasting their manure and injuring the land by tramping. Our stock must be sheltered that we may save both food and manure, and the farmer should plan to produce the largest bulk and best quality of manure possible, and will find that under a wise and provident system of cattle feeding and manure saving his winter's work can be made profitable and pleasant.

In all that pertains to the barn and barn-yard, there should be careful thought and planning that every thing be arranged with a view to economy of time and labor, and so as to insure comfort to the animals and a saving of manure. A small, cheap barn may be so conveniently arranged, and so supplemented by sheds, may be so convenient of access, and the drainage of the barn-yard so well provided for as to give better satisfaction to the owner and more comfort to the stock than one costing twice as much money where these details have not been made a matter of careful thought and study. There are many old barns which may be greatly improved, and often at a small expense, by the addition of sheds, or changing the interior arrangements.

The farmer intending to build a barn should never be hasty in deciding on a plan. He should take into consideration all that is connected with the work to be done, the handling of

food for his stock, the storing and handling of hay, grain and manure, the water supply, the approaches to the barn, for men, beasts, and vehicles, and should be sure before he begins to build that he has every thing planned conveniently and economically. It will pay to spend a day (or several days) in visiting and examining the barns of your neighborhood, noting both their defects and excellencies. Do not make the mistake of using poor, cheap material in the construction of a barn or shed. The best is the cheapest always, and all the work should be done thoroughly, and in a workmanlike manner. It is far wiser to economize by putting up a small barn, and adding to it when you are able, than to build a large one of poor material. We give some barn plans, not with the expectation that they may be exactly what any of our readers will wish to adopt, but with the hope that they will be found helpful, and that if not adopted they will at least furnish some suggestions as to arrangement, etc.

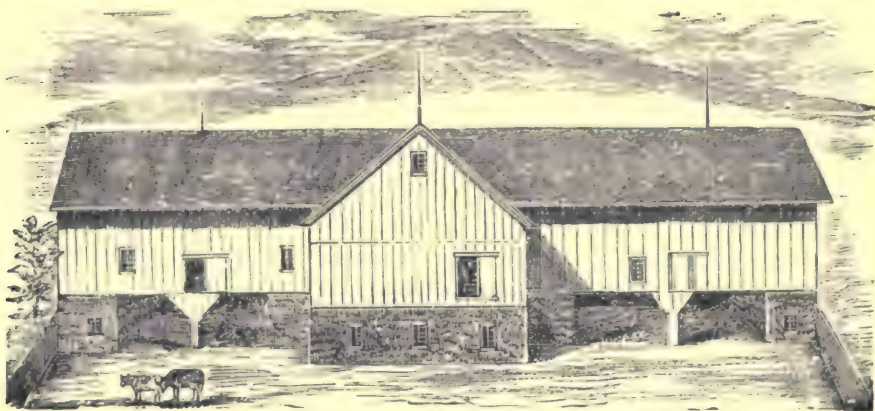


A TASTY AND CONVENIENT BARN.

The engraving shows a tasty and convenient barn, and one which the farmer can modify to suit his wants as to size and interior arrangements.

The illustration on page 1195 shows a basement or bank barn, which will be found a convenient stock barn. The upper part is used for storage, and the stables are below. The wing contains the granaries and a store-room for implements. The drive-way by which the barn is entered is on the opposite side from that shown in the engraving. The basement is eight feet high.

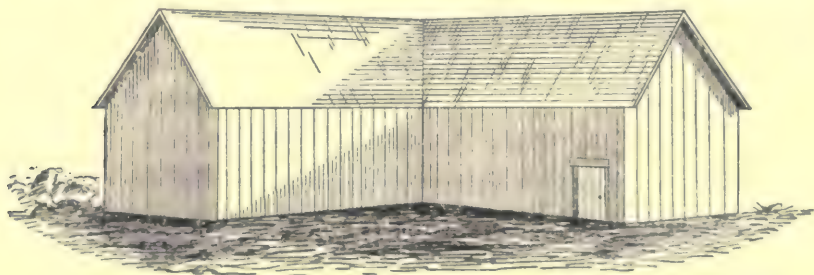
In our wheat chapter we speak of barracks for storing wheat, and promise in this chapter an engraving and bill of lumber, with approximate estimate of cost. As there are many



A BANK BARN.

farmers of small means who must run in debt for a barn, and who should build so that when able they can add to it conveniently, I give here a plan which will meet the wants of such.

One of the wings shown in the engraving can be put up and used for barracks, or as a cheap barn; and when more room is needed, or the farmer has the means, the other wing can be added. It is not designed to use any timber larger than six



A CHEAP BARN AND BARRACKS.

inches square in this building, as when used for barracks it will be filled so that all the weight will rest on the ground, and if one wing is used for stabling the loft can be so well supported by studding below as to bear all the weight that can be put on it. In using this light timber it is not best to build wider than twenty-six feet. The bill of lumber here given is for a build-

ing twenty-five by forty-two feet; but, as lumber is usually cut in even lengths, it would be better to make the building either twenty-four or twenty-six feet wide.

BILL OF LUMBER

FOR BARN OR BARRACKS TWENTY-FIVE BY FORTY-TWO FEET, WITH SIXTEEN-FEET POSTS.

Two sills, 6 by 6 inches, 42 feet long,	264 feet.
Four sills, " " 25 "	300 "
Ten posts, " " 16 "	480 "
Nail ties, two run all around, 4 by 4 inches,	364 "
Six collar beams, or tie beams, 6 by 6 inches, 25 feet long,	450 "
Two plates, 4 by 6 inches, 42 feet long,	176 "
Brace timber, 3 by 4 inches,	160 "
Forty-four rafters, 2 by 5 inches, 16 feet long,	586 "
Sheathing, 1 by four inches,	900 "
<hr/>	
Total frame lumber,	3,680 "
To inclose this building will require, of	
Weather boarding,	2,400 "
Shingles, 9,500.	

The price of lumber will vary in different localities; but it would cost me, delivered on the ground, as follows:

3,680 feet of hard frame lumber, at \$15 per M.,	\$55 20
2,400 feet of weather boarding, at \$17.50 per M.,	42 00
9,500 shingles, at \$4.25 per M.,	40 37½
<hr/>	
Making a total for lumber of	\$137 57½

I have allowed, on the plates and long sills, two feet of length extra, as they would need to be spliced, as we could not get timber sawed forty-two feet long.

Ten dollars would, I think, be a liberal allowance for nails and hinges, which would bring the cost of material for the building to a little less than \$150. I have not an exact estimate of the carpenter work; but I read over my plan and bill of lumber to two experienced carpenters, and they both said the cost of work would not exceed fifty dollars. At my estimate for lumber, it can be built so as not to cost over five dollars per lineal foot, or \$210 for the building, forty-two feet long.

The amount of storage required for wheat varies so with the season, variety, degree of ripeness, etc., that no exact estimate of capacity can be given; but I think that enough wheat

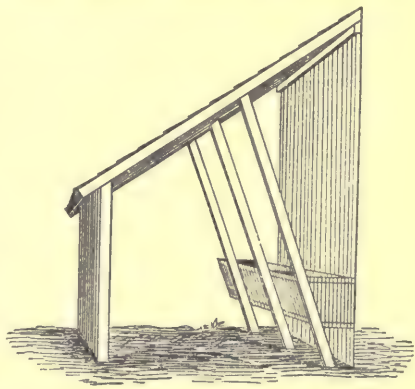
to thresh out from five hundred to eight hundred bushels can be stored in this building.

I am aware that this plan is open to criticism, from the fact that considerably less lumber and shingles would be required to inclose the same amount of space if the building was made more nearly square; but I think that this objection is more than overbalanced by the fact that much heavier timber would be needed in the square barn, and that a barn such as shown in our engraving furnishes good protection to the barn-yard, and enables the farmer of small means to build at different times. When the right-angle barn is built, it is best to locate the stables in the corner where the wings join, so that food can be easily taken from either wing. The stables may face each other, and the stock feed from a floor some two feet higher than the floor of the stable, as this is much more convenient than to crowd the hay or fodder into a manger. When the single building is to be used as barracks for storing grain, I would divide into three parts, two fifteen feet wide, and a middle space twelve feet wide, and hang doors, so as to have a drive-way through the center. The bays can first be filled on either side, and afterwards, if the space should be needed, the drive-way.

Approaches.—I advise that the barn-yard be always so located that there will be no necessity of passing through it to reach the stable. If it is not convenient to locate the barn-yard at the rear, so that you can enter the stable from the opposite side, fence off a passage-way between the stable and the barn-yard, wide enough for a wagon-drive, and turn the stock across this into the barn-yard. It is impossible to keep the approaches to the barn clean if the stock is allowed to stand at the doors tramping and dropping their dung. There is no reason why a barn should not be so arranged that the farmer can reach it at any time without soiling his boots.

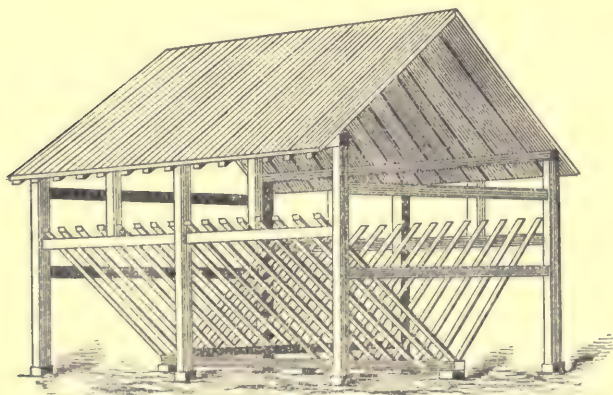
On many farms the barns afford sufficient room for storage, but are deficient in stable room. Our engraving shows a cheap and good method of attaching a shed to a barn. The posts which you notice lean from the barn answer a threefold purpose.

They support the manger and feed-boxes, they are set the right distance apart for partitions to the stalls, and they support the roof. By making this shed with high posts quite an amount of storage room will be furnished, and the weatherboarding can be taken off from the barn to cover it, and this will make the loft above the shed accessible from the barn. In many cases such a shed would add largely to the comfort of the stock and the convenience of the owner in caring for them, and the expense of building it would be but little more than the cost of the roof.



LEAN-TO SHED.

If the farmer has a small machine for threshing, or if he feeds a large amount of corn-fodder, the shed and rack shown in the engraving will be found a great convenience. It may be located at the end of the barn floor, so that the straw from the machine can be run directly into it, and is so arranged that the straw will settle down as fast as the cattle eat it out from below. It



A CHEAP FEEDING-SHED AND RACK.

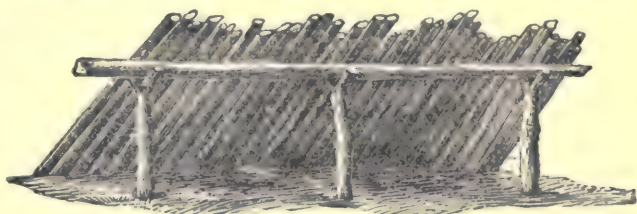
can be made of a size to suit, but should be at least large enough to hold the straw from fifty bushels of wheat. As the farmer will often wish to walk through the rack either in filling it or to remove any waste

that may accumulate, there should be a board twelve or fifteen inches wide fitted in the center for a walk.

It will pay on every farm to save the straw, as good, bright

wheat-straw, when fed in connection with grain, has more than half the feeding value of average hay. On many farms it is left in the field, or is so poorly stacked as to be of little value. It should also be so arranged as to afford shelter as well as food.

Our engraving shows a good, cheap, and strong rack for stacking. There should be two of them, a suitable distance apart, to hold the straw. The forks should be of durable wood, and well set in the ground, and the poles strong. The sloping uprights should not be laid close together, but should be ten inches apart, so that the cattle can get enough straw through to eat and bed themselves. One upright at each end should be fastened to the pole at the upper end, and sunk in the ground at the bottom, or the cattle will be likely to push it



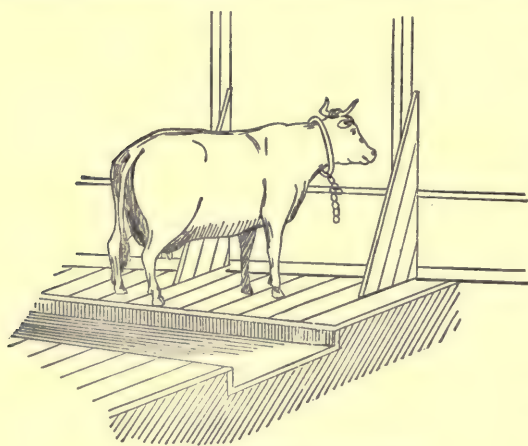
RACK FOR STACKING STRAW.

down when the pressure of the straw is removed. A stack of good straw in the barn-yard is a great comfort to the stock, as they will pull down enough to keep the yard dry and comfortable, and none of the droppings, either liquid or solid, will be lost in a yard well bedded.

The barn-yard should always be so arranged that no water can flow into it from adjoining land. If from the natural slope of the land there is danger of this, good surface ditches should be made on the upper side to carry the water around it. If the barn-yard is on flat land, it will pay to raise it a foot or more by plowing and scraping from the land adjoining, for if this is not done in a few years the barn-yard will be lower than the general level, and thus receive the drainage and be likely to become a mud-hole. With a barn-yard of such a size that every foot of it is covered with some good absorbent, and so made that there shall be no drainage either to or from it, and the manure managed as described in Chapter IV, there need be but little waste of fertilizers on the farm.

In the cattle chapter I speak of the manure ditch and the

form of partitions in the cow-stable. Our illustration gives a good idea of them. The floor on which the cows stand must be as short as will answer, or they will drop dung on it and lie down in it. For average sized cows I recommend that the floor be four feet nine inches long, and a variation of a few inches either way will adapt it to large or small cows. The floor should be of such length that when the cow stands with her head in the manger the dung will drop into the ditch. The cow in lying down soon learns to lie at an angle in the stall so as not to project over the ditch. Make the manure ditch eight inches deep, and of such width that you can easily step across it, and then the boots will never be soiled when you go into the stable with a poor light. The ditch may be made deeper and wider for fattening and stock cattle, so as to hold a week's droppings if desired, for as we always pass through the manger in front of the cattle in fastening or loosening them, there is no necessity of going behind them, except to clean the stable. In arranging a



COW-STALLS AND MANURE DITCH.

stable for fattening cattle two rows can stand facing from each other, with a manure ditch between them six feet wide, and large doors at each end, so that the wagon can be driven through and the manure taken directly to the fields. The boards in the floor of the manure ditch should always run

lengthwise, so that the shovel will slip easily on them. Arranged in this way, a building a little over twenty feet wide would accommodate two rows of cattle, as two and a half feet is wide enough for the mangers, a little less than five feet for each raised floor, and six feet for the manure ditch.

For the cow stable I very much prefer the short, sloping partitions shown in the engraving, as the milker does not want to

run any risks of being crowded against a partition, and all that is necessary is to have the partitions extend back far enough so that the cows can not steal each other's feed or horn each other. In the cow stable the stalls should be full four feet wide, but for other cattle they may be a little narrower. I would prefer some other material than boards for the floor, as I have always found a board floor a harbor for rats. For cows a satisfactory floor can be made by pounding in tough yellow clay, as they will always urinate in the ditch, but steers would be likely to make it too soft and muddy as their urine would fall

on the floor. The cement called "liquid stone," which is used for pavement would, I think, make an excellent floor. When a clay or cement floor is to be laid a timber should be put down next the manure ditch for the edge.

Another way in which cattle can be kept clean in the stable is by means of a slatted floor. This should be raised high enough above the stable floor so that with a hoe or shovel it will be easy to take the dung from under it. The slats should be of strong and durable timber three inches wide at the top or upper

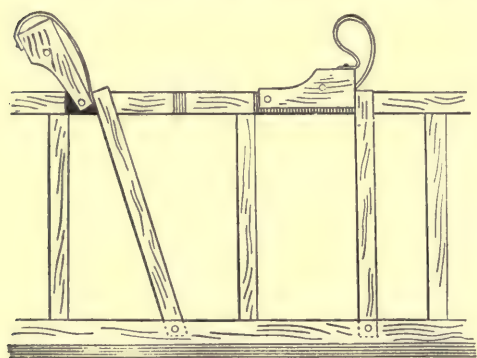


SLATTED FLOOR.

side, and beveled to two inches at the bottom, which will prevent the cracks from becoming clogged. The best width for the cracks is about two inches. I think it would be easier to keep this slatted floor clean if the slats run lengthwise of the stall instead of across as shown in the engraving, for there

would some dung lodge on it which would need to be scraped off, and it would be easier with a hoe to do this from behind if the slats run lengthwise.

Our engraving shows how a stanchion is made and how fastened. Both the upright and latch are secured by a single bolt which is loose, so they play freely on it. I would have stanchions in every cow stable, but would not leave the cows in them



STANCHIONS.

over night, as cattle can not be so comfortable in them as when tied. I would not tie with a rope around the neck unless the cow was hornless, but I would use a short rope or strap around the horns with a small iron ring on it. This ring should be secured so as to hang in the middle of the forehead,

and this can easily be done by wrapping a strong string around the horns and securing the ends to the ring. The object is to have the ring always in a position easy of access, so that a snap can be fastened or detached in a twinkling. When the rope or strap is placed around the neck the ring always hangs underneath, and in stooping to reach it there is some danger of being injured by the horns. I have tried many cattle ties, but have found nothing so satisfactory as the ring and snap, as it is easily operated and never comes unfastened.

There should be in every stable where milking is done a good, safe shelf for milk pails and stools, and a good broom, shovel, and hoe for scraping the manure from the floor should always be ready for use.

CHAPTER XXIII.

AGRICULTURAL APHORISMS.*

"Whatsoever ye would that men should do unto you, do ye even so unto them."

IF the heart is not in the farm, the life should not be upon it.—Profit depends more upon the farmer than the farm.—The best subsoil is a wise plan.—An active brain is a greater labor-saving machine than the self-binder.—Plan and work ahead: bright brains and brown hands make the farm pay.—The basis of success is wise management, the result of correct reasoning from facts gained by the experience, observations, and investigations of self and others.

Do not fret.—Keep a diary.—Watch the markets.—Study crop reports.—Assort your products.—Quality is as important as quantity.—Sell when your produce is ready for market.—Neither a borrower nor a lender be.—Stick to your business and it will stick to you.—No man can farm by proxy.—Reduce all contracts to writing.—Pay no money without taking a receipt, buy no property without having the title examined, sign no paper for a stranger, and have no destructible property not insured.

The farmer's wheel-of-fortune: a rotation of crops.—In the rotation of crops on hilly lands, make cultivated crops only one spoke in the wheel.—The problem of making a farm profitable is solved by the rule of three: fewer acres, more work, larger yields.—Do work at the earliest seasonable moment; the man chased by his work stumbles over many dollars.—As order is neglected, wastes become systematic, and losses regular.—Cultivate the home market.—Be courteous enough to escort every thing to its place, that it may be at home when next you call on it.—More work with less labor is reflected from bright, sharp tools.—Effort concentrated on small areas economizes materials

* By JOHN M. STAHL, editor of *Farmers' Call* and *South and West*.

and labor.—Feed the soil with the food it needs.—Kindness is accepted at par, and repaid with interest by stock, employes, and family.—It is not good policy to leave any work to do itself, except Sunday work.—The man too smart to pay the price asked by a reliable dealer is just smart enough to be gulled by a sharper.—Accounts are sign-boards which both show where you are and have been, and point to the right road.—Better to lose a good horse trade than self-respect, and it is very hard to keep both.—When a farmer once owns a 2:30 trotter, he can not drive fast enough with even that to overtake his money.—The manure bank is the best savings-bank, and the safest bank of deposit is a bank of earth.—The man who takes a good agricultural paper has the Extract of Agriculture in his house.—The lack of a haymow is the possession of a hole in the pocket.—Some farming is like a sieve: small holes, but the profit gets through.—Dig no holes to fill again.—Aid the fairs.—Poor laborers are multiplied evils.—Above the barn door: “O ye that enter me, leave pipes behind.”—Raise large crops that leave the farm richer than they found it.—Not only increase your productions, but save and market them better.—A little ready cash will not wait long for profitable use; better have money in your pocket than land unpaid for.—Begin with new crops and varieties on a small scale, enlarging as you gain experience.—Generosity to man, beast, and soil is profitable.—Cleanliness is health in the house and stable.—If Nebuchadnezzar learned the virtues of grass, he got some valuable agricultural information.—Very often the problem of converting an impoverished, unprofitable farm into a fertile, profitable one is the easy addition of grass and stock.—After intelligent and careful deliberation mark out your course, and then adhere to it; capricious changes are always unwise.

Debt has not night or Sabbath; interest never goes a-fishing.—When debt enters the house, content departs; and when a mortgage shadows the home, foreboding and disquiet take their places at the fireside.—I have seen a man too poor to buy shoes for his wife, yet rich enough to buy more land.—Buy a farm suited to your means, adapted to your tastes, affording a good

water supply, convenient to markets reached by good roads, and in a moral, wide-awake community.—Mr. Intensive Farming bought out his neighbor, Mr. Extensive Farming, some years ago, and put up a new house and barn, while the latter went West, where land was cheap and the cow could run on the range.

Underdrains make soil faster than the glaciers.—When a man plants tile he plants that which needs neither manure nor cultivation, and which yields many crops.—God sends his rain upon the just and the unjust alike, and he makes his seasons the same for all men; but tempered drought and lessened flood, earlier spring and later fall has the man with a well drained farm.—I have seen men add acres to their farms by putting in the earth tile, or manure, or labor.

For all parties it is cheaper for a man to fence his own stock in than to fence all others out.—Reduce the amount of fencing by grouping plowed and mowed lands together.—Have fencing like Aunt Jane's onion: little, but strong.—Weak fences are the teachers that graduate breachy stock.—The crops grown in the fence corners mar many a farm.—The man who puts up a gate adds a day to the year.

An idle plow half hid by the weeds in a fence corner suggests improvidence kicking success out of the front door.—Waste and ill luck are twins.—Rot and rust eat faster than wear and tear.—Paint to the wood, and oil to the steel of farm machinery not in use, is gain to the farmer.—Paint costs less than new boards and beams.—A workshop both makes and saves.—Repairs made early are made with ease and cheapness.—It is better to strengthen a weak place than to mend a break.—It is fully as important to utilize completely as to produce abundantly.—The man who burns his own straw is not accounted a felon; yet he robs his stock, his farm, his family, and his country.—It is said that this man raises thirty and that man sixty bushels of corn per acre, but no note is taken of the fodder, so little of it is saved; yet of corn the fodder is almost as valuable as the grain.—If straw and corn fodder were saved, we could winter more than twice the number of cattle we now have.

Uncle Sam could better afford to lose half the revenues of

his government, than the manure his tenants waste.—I have seen a man throw an ear at a pig that was stealing a nubbin; and I have seen a man save the solid manure and allow the urine to waste.—Wind and rain will haul the manure without wages, but they are dear hands.—Collect and keep manure by the use of absorbents and shelter.—Ammonia loves a level, solid manure pile, but it departs from a conical, loose one.—Manures, like some drugs, are most powerful when finely divided.—Nature is a good farmer, and it puts manure upon the surface.—A sandy subsoil and a bare surface are the Scylla and Charybdis of manure.—He who sows a crop for green manuring puts to work in his behalf ten thousand alchemists that from hidden depths take minerals and change them into fertility, and that coin plant food out of air.

I have never heard a man complain that he had tilled his land too well.—After you have prepared the land thoroughly for a crop, harrow and roll it once more.—Firm the seed-bed.—Plow heavy soils as deep as you can fine them.—When the soil and the season are right the moon is right.—Weeds are robbers.—Weeds are always hungry, and the more they have the more they want.—The smallest weed is the one most easily destroyed, yet the weed most easily destroyed is the one not allowed to germinate.

Keep the corn-planter close after the plow.—When seed, selected early and well dried, is seasonably planted on pulverized sod, a big corn crop is half made.—Test seed corn a month before planting time.—Clover for corn, stable manure for wheat.—The plow, harrow, and roller should go early and keep close company in the field for wheat.—Drill one bushel of wheat per acre, putting it one inch below the surface of a powdered seed-bed.—The big cotton bale said it was planted early.—The gin and the ginner make or unmake one-fourth of the price of the cotton.—Poor baling is baleful to cotton, as poor shocking is shocking to wheat.—Killing the first cotton moth is killing ten thousand later.—Mix the cotton seed meal with corn or corn fodder and feed it at home.—There is not room for one weed in the tobacco seed-bed.—Plant tobacco plants as you should

diseased carcasses—deep and solid.—The early tobacco plant lost only its head; the late one half its body.—Plant potatoes largely when they go begging.—When sizing the potato patch remember that every hog is an Irishman.—The big potato grew early on fall plowed land.—The potato tuber should carry an umbrella; rain or sun quickly injures it.—Raise your own sweet potato plants from perfect seed planted a month before the plants are wanted.—Puddle the roots of sweet potato plants before transplanting, and firm the earth about them.—Sow rye between crops for pasture and manure.—Pumpkins are good stock medicine.—Sow turnip seed after a rain.

A tree planted will blossom with pleasures, and fruit with profits.—Good corn land is poor fruit tree land.—An orchard does not make a good mule pasture.—Fruit trees, like grain and stock, must have food and care.—Commune not with the fruit tree agent armed with colored plates and an oily tongue.—Plant fruit trees one or two years old.—When selecting new varieties of fruit, consult your neighbors.—Hogs in the orchard furnish a case of mutual benefit.—Keep a young orchard in low, cultivated crops; an old orchard in clover.—Neglect never made a success of fruit-raising.—Make a bush of the raspberry by pinching the cane off when two feet long.—Precede strawberries with clover.—Good taste made his fruit attractive, and got the highest price for it.—The doctor sighs over a full orchard and a good garden.

Put the garden on rich, warm, well-drained land, free from weeds.—When a man tells me he can not have a good garden I know that his hoe is rusty.—You can not make a fence hold more health and money than by putting it around a good garden.

A strong plant is the best remedy for insects.—The cut-worm is sure that the birds should be killed.—When the Hessian Fly turns agricultural writer, he will make his first article against late sowing and a fast growing plant.—Fall plowing, frequent harrowings, and many birds, form the combination to which cut-worms, white grubs, and wire-worms succumb.—The apple tree borer is one of the few things which will not endure soft soap.—The black bird acknowledged the corn, but proved it had an appetite for grubs.

Forests temper drought and flood, heat and cold.—Trees will yield a steady income on land unfit for cultivation.—Prepare land as thoroughly for trees as for grain.—A tree does not need annual cultivation, and it does its own manuring.

It makes both the farm and pocket richer to put crops on four legs.—An old cow or a runty pig is as devoid of profit as a mule is of poesy.—Regularity is a valuable indorsement on feeding, watering, milking, and salting.—Better green feed than medicine; better to go to the lumber yard than to the horse doctor.—Shelter and kind treatment are equivalent to food.—Putting up stock shelters enlarges the cribs.—A pound of flesh lost is twice lost, for the waste of the body must be provided for while it is being regained.—Unnecessary exercise is waste of food.—The strongest feeding consistent with health and complete digestion, and of concentrated, agreeable foods, is the most profitable feeding.—The more easily food is digested, the more of it is digested; and a certain amount of digested matter digested easily makes more gain than the same amount digested with difficulty.—Selling two poor animals to buy one good one is the beginning of wisdom in stock raising.—Keep the best and sell the rest.—To breed immature animals is poor policy.—Straw or saw-dust used liberally for bedding saves the urine and keeps the animals clean.—As age is added to an animal a certain amount of food makes less growth, *i. e.*, gain.—Summer-made flesh costs less than winter-made.—Generally, the profit of flesh and fat is increased as the time of their production is decreased.—Good animals regularly supplied with reasonable allowances of wholesome food and drink, and properly sheltered and treated, do not eat their heads off.—Keep good stock suited to the character and size of your farm, so fed and treated as to lead to their best development, and so managed as to increase the fertility of the land.—Feed dry food with roots.—Change food gradually.—Better one animal full-fed than four half-fed.—For stock for the shambles make each day a day of gain.—Small shelters are poor economy.—The full bite is the profitable one.—Though pasture be in excess it is not lost.—A variety of food for farm stock is essential, and this must be in the pasture as

well as the feed trough.—It is better to combine grass and grain feeding than to separate them.—Adding to the grazing season subtracts from the cost of flesh.—A well or cistern kept closed from impurities is the only safe water supply.—Soiling saves land, fences, food, and weeds, and increases valuable products.—Growing an animal and fattening it afterwards went out of fashion some time ago.—The man who pastured corn-stalks is the long-lost brother of the man who spoiled his knife fashioning a flint, and the strawberry mark is “Penny wise and pound foolish.”—Every farm animal should be a pet.—Castrate the calves when a week old.—Muscle, not fat, makes the good breeding animal.—Breed from the best.—The best animal, valued for its flesh, milk, or wool, is the one that produces most and best from a certain amount of food.—The best animal, valued for its labor, is the one with the most bone and muscle rightly placed, and the most spirit and energy rightly controlled.—Disease renders unfit the best formed sire.—Never deprive breeding animals of moderate exercise.—A scrub sire is a bad bargain at any price.—Pedigrees are like wine: the older the better.—Pedigrees are good evidence, but not proof.—The most masculine male is the best sire, and the most feminine female the best nurse and suckler (but not always the best mother).—Year after year use the best pure-bred males on the highest grade females.—The male determines the externals, the female the internals.—Fitting for show is too often unfitting for breeding.—The steak will not tell you the color of the hair it grew under.

Endurance, breeding, and size should mark the stallion; soundness, activity, and docility the mare.—Good colts are not unprofitable.—Colts, like children, should have work and education while young.—Put the barn high and keep it dry.—Kindness to a mule is not misplaced.—A good mule is a treasure; but a mule soured by abuse is worse than a scolding wife.—Good pasture, good cattle.—The beef animal should grind its own corn, a hog completing the work.—Butter colors should be put in the cow, not in the bowl.—Quality determines the profit of butter.—Butter-milk is the inveterate foe of the butter.—In a dairy the thermometer is as essential as the cow.—Cold

water removes the caseine better than elbow grease.—The market weakens as the butter grows stronger.—Pregnant ewes must have exercise.—Merinos for poor land and the range; English breeds for good land and small farms.—Give the sheep fodder for breakfast, grain for dinner, and hay for supper.—Eternal vigilance is the price of lambs.—The best articles in the shepherd's medicine-chest are good feeding, good care, exercise, water, and salt.—It was a wet foot that made the sheep sick.—Grow and fatten early spring pigs on pasture (mostly clover) during the summer and early fall, and then rapidly fatten on grain.—Clover and swine plague had a contest, and clover was victor.—Always have some hogs to connect with the kitchen by means of the slop-barrel.—A hog loses profitableness when brought on rolling land.—It is of very doubtful profit to furnish a hog with a cook.—The only valuable remedy for swine disease: inherited vigor, pure water, a variety of wholesome food regularly given, and clean, airy quarters, equal parts; mix, keep shaking the bottle, and give every minute.

It was dampness that made Biddy take to her bed.—It was a sad day among the insects and grubs when the poultry marched into the field.—Set out plums and small fruits in the poultry-yard.—Make heat the first thing on the breakfast bill of fare in the poultry-house in cold weather.—Ground bone put the egg foundry in operation.—When the hen has gone to grass she goes to lay.—Give poultry green food, vegetable scraps, pure water, lime, gravel, dust bath with sulphur in it, and warm, lighted, ventilated, white-washed quarters.—Three things are there quoted firm in the market reports: whisky, tobacco, and April broilers.—Hamburgs and Leghorns for many eggs, Houdans and Black Spanish for fewer but larger eggs; Brahmas, Cochins, Plymouth Rocks, and Langshans for eggs and dressed meat for winter market; Plymouth Rocks, Dominiques, and Wyandottes for early broilers.—Do not choose the chicken-hearted cock for breeding.—Build the apiary on promptness and persistence.—The quiet colony needed little crape during the winter.—The three points of successful wintering: uniform temperature, sufficient food, pure air.

Have a *home*.—The home is above the farm.—If your wife's lips are not so sweet ten years after marriage as ten days before, something is wrong, and you should seriously consider if you are not that something.—There is a large number of farmers' wives in the insane asylum, and not one of them was driven to insanity by labor-saving appliances in the kitchen.—The best products of your farms are your sons and daughters, and they should receive ten times the care bestowed upon other crops.—Books, papers, pictures, and games in the home are good antidotes for the cityward longing.—Money spent to make the farm and home attractive bears good interest.—A damp cellar and a slop-hole at the back door are good luck to the doctor.—Neglect of house drainage is an invitation which disease always accepts.—Well and wood-shed near the kitchen door makes wife smile.—The farm should yield more than money, and the family more than work.—The farm-house is for use before ornament, but comfort need not sacrifice beauty.—Begin the plan of your house at least a year before you begin to build.—Make air and sunshine the first items in the specifications for the house.—An elm is a good annex to the house.—Make the garden, pump, wood-house, smoke-house, and kitchen close neighbors.—The good farmer or his wife or his children or his man-servant or his maid-servant does not chop stove-wood during the hot season.—Man may be a diamond, but he is in the rough till society polishes him; this the farmer, whose vocation sentences him to not a little solitary confinement, should never forget.—If Solomon had been a farmer he would have organized a farmers' club for his own benefit, and made a signal display of his wisdom by so doing.—Clean implements, clean harness, clean animals, clean fence corners, clean fields, clean garden, clean orchard, clean yard, clean pasture, clean seeds, clean stables, clean shelters, clean troughs, clean food, clean water, clean litter, clean sleeping quarters, clean granaries, clean cellar, clean house, clean children, clean conscience, clean profits.

APPENDIX.

PRINCIPAL CEREAL PRODUCTIONS OF THE UNITED STATES.

From the Official Report of the Tenth Census, 1880.

STATES AND TERRITORIES.	INDIAN CORN. Bushels.	WHEAT. Bushels.	OATS. Bushels.	BARLEY. Bushels.	RYE. Bushels.	BUCKWHT. Bushels.
Alabama . . .	25,451,278	1,529,657	3,039,639	5,281	28,402	363
Arizona . . .	34,746	136,427	564	239,051		
Arkansas . . .	24,156,417	1,269,730	2,219,822	1,952	22,387	548
California . . .	1,993,325	29,017,707	1,341,271	12,579,561	181,681	22,307
Colorado . . .	455,968	1,425,014	640,900	107,116	19,465	110
Connecticut . . .	1,880,421	38,742	1,009,706	12,286	370,733	137,563
Dakota . . .	2,000,864	2,830,289	2,217,132	277,424	24,359	2,521
Delaware . . .	3,894,264	1,175,272	378,508	523	5,953	5,857
Dist. Columbia	29,750	6,402	7,440		3,704	
Florida . . .	3,174,234	422	468,112	210	2,965	
Georgia . . .	23,202,018	3,159,771	5,548,743	18,662	101,716	402
Idaho . . .	16,408	540,589	462,236	274,750	4,341	
Illinois . . .	325,792,481	51,110,502	63,189,200	1,229,523	3,121,785	178,859
Indiana . . .	115,482,300	47,284,853	15,599,518	382,835	303,105	89,707
Iowa . . .	275,024,247	31,154,205	50,610,591	4,022,588	1,518,605	166,895
Kansas . . .	105,729,325	17,324,141	8,180,385	300,273	413,181	24,421
Kentucky . . .	72,852,263	11,356,113	4,580,738	486,326	668,050	9,942
Louisiana . . .	9,906,189	5,034	229,840		1,013	
Maine . . .	960,633	665,714	2,265,575	242,185	26,398	382,701
Maryland . . .	15,968,533	8,004,864	1,794,872	6,097	288,067	136,667
Massachusetts	1,797,593	15,768	645,159	80,128	213,716	67,117
Michigan . . .	32,461,452	35,532,543	18,190,793	1,204,316	294,918	413,062
Minnesota . . .	14,831,741	34,601,030	23,382,158	2,972,965	215,245	41,756
Mississippi . . .	21,340,800	218,890	1,959,620	348	5,134	
Missouri . . .	202,485,723	24,966,627	20,670,958	123,031	535,426	57,640
Montana . . .	5,649	469,688	900,915	39,970	430	437
Nebraska . . .	65,450,135	13,847,007	6,555,875	1,744,686	424,348	17,562
Nevada . . .	12,891	69,298	186,860	513,470		
N. Hampshire	1,350,248	169,316	1,017,620	77,877	34,638	94,090
New Jersey . . .	11,150,705	1,901,739	3,710,573	4,091	949,064	466,414
New Mexico . . .	633,786	706,641	156,527	50,053	240	
New York . . .	25,875,480	11,587,766	37,575,506	7,792,062	2,634,690	4,461,200
N. Carolina . . .	28,019,839	3,397,393	3,838,068	2,421	285,160	44,668
Ohio . . .	111,877,124	46,014,869	28,664,505	1,707,129	389,221	280,229
Oregon . . .	126,862	7,480,010	4,385,650	920,977	13,305	6,215
Pennsylvania	45,821,531	19,462,405	33,841,439	438,100	3,683,621	3,593,326
Rhode Island	372,967	240	159,339	17,783	12,997	1,254
S. Carolina . . .	11,767,099	962,358	2,715,505	16,257	27,049	
Tennessee . . .	62,764,429	7,331,353	4,722,190	30,019	156,419	33,434
Texas . . .	29,065,172	2,567,760	4,893,359	72,786	25,399	535
Utah . . .	163,342	1,169,199	418,082	217,140	9,605	
Vermont . . .	2,014,271	337,257	3,742,282	267,625	71,733	356,618
Virginia . . .	29,106,661	7,822,504	5,333,181	14,223	324,431	136,004
Washington . . .	39,183	1,921,322	1,571,706	566,537	7,124	2,498
West Virginia	14,090,609	4,001,711	1,908,505	9,740	113,181	285,298
Wisconsin . . .	34,230,579	24,884,689	32,905,320	5,043,118	2,298,513	299,107
Wyoming . . .		4,674	22,512		78	
Total U. S. .	1,754,861,535	459,479,505	407,858,999	44,113,495	19,831,595	11,817,327
Census of 1850	592,071,104	100,485,944	146,584,179	5,167,015	14,188,813	8,956,912
Census of 1860	838,792,742	173,104,924	172,643,185	15,825,898	21,101,380	17,571,818
Census of 1870	760,944,549	287,745,626	282,107,157	29,761,305	16,918,795	9,821,721

NUMBER OF LIVE STOCK IN THE UNITED STATES IN 1880.

From the Official Returns of the Tenth Census, 1880.

STATES AND TERRITORIES.	Horses.	Mules and Asses.	Working Oxen.	Milch Cows.	Other Cattle.	Sheep.	Swine.
Alabama . .	113,950	121,081	75,534	271,443	404,213	347,538	1,252,462
Arizona . .	6,798	891	984	9,156	34,843	76,524	3,819
Arkansas . .	146,333	87,082	25,444	249,407	433,392	246,757	1,565,098
California . .	237,710	28,343	2,288	210,078	451,941	4,152,349	603,550
Colorado . .	42,257	2,581	2,080	28,770	315,989	746,443	7,656
Connecticut .	44,940	539	28,418	116,319	92,149	59,431	63,699
Dakota . .	41,670	2,703	11,418	40,572	88,825	30,244	63,394
Delaware . .	21,933	3,931	5,818	27,284	20,450	21,967	48,186
Dist. Colum.	1,027	68	4	1,292	271	. . . .	1,132
Florida . .	22,636	9,606	16,141	42,174	409,055	56,681	287,051
Georgia . .	98,520	132,078	50,026	315,073	544,812	527,589	1,471,003
Idaho . .	24,300	610	737	12,838	71,292	27,326	14,178
Illinois . .	1,023,082	123,278	3,346	865,913	1,515,063	1,037,073	5,170,266
Indiana . .	581,444	51,780	3,970	494,944	864,846	1,100,511	3,186,413
Iowa . .	792,322	44,424	2,506	854,187	1,755,343	455,359	6,034,316
Kansas . .	430,907	64,869	16,789	418,333	1,015,935	499,671	1,787,969
Kentucky . .	372,648	116,153	36,166	301,882	505,746	1,000,269	2,225,225
Louisiana . .	104,428	76,674	41,729	146,454	282,418	135,631	633,489
Maine . .	87,848	298	43,049	150,845	140,527	565,918	74,369
Maryland . .	117,796	12,561	22,246	122,907	117,387	171,184	335,408
Massachus'ts	59,629	243	14,571	150,435	96,045	67,979	80,123
Michigan . .	378,778	5,083	40,393	384,578	466,660	2,189,389	964,071
Minnesota . .	257,282	9,019	36,344	275,545	347,161	267,598	381,415
Mississippi . .	112,309	129,778	61,705	268,178	387,452	287,694	1,151,818
Missouri . .	667,776	192,027	9,020	661,405	1,410,507	1,411,298	4,553,123
Montana . .	35,114	858	936	11,308	160,143	184,277	10,278
Nebraska . .	204,864	19,999	7,234	161,187	590,129	199,453	1,241,724
Nevada . .	32,087	1,258	765	13,319	158,137	133,695	9,080
N. Hampsh'e	46,773	87	29,152	90,564	112,689	211,825	53,437
New Jersey . .	86,940	9,267	2,022	152,078	69,786	117,020	219,069
New Mexico . .	14,547	9,063	16,432	12,955	137,314	2,088,831	7,857
New York . .	610,358	5,072	39,633	1,437,855	862,233	1,715,180	751,907
N. Carolina . .	133,686	81,871	50,188	232,133	375,105	461,638	1,453,541
Ohio . .	736,478	19,481	8,226	767,043	1,084,917	4,902,486	3,141,333
Oregon . .	124,107	2,804	4,132	59,549	352,561	1,083,162	156,222
Pennsylv'a . .	533,587	22,914	15,062	854,156	861,019	1,776,598	1,187,968
R. Island . .	9,661	46	3,523	21,460	10,601	17,211	14,121
S. Carolina . .	60,660	67,005	24,507	139,881	199,321	118,889	628,198
Tennessee . .	266,119	173,498	27,312	303,900	452,462	672,789	2,160,495
Texas . .	805,606	132,447	90,502	606,176	3,387,927	2,411,633	1,950,371
Utah . .	38,131	2,898	3,968	32,768	58,680	233,121	17,198
Vermont . .	75,215	283	18,868	217,033	167,204	439,870	76,384
Virginia . .	218,838	33,598	54,709	243,061	388,414	497,289	956,451
Washington . .	45,848	626	3,821	27,622	103,111	292,883	46,828
W. Virginia . .	126,143	6,226	12,643	156,956	288,845	674,769	510,613
Wisconsin . .	352,428	7,136	28,762	478,374	622,005	1,336,807	1,128,825
Wyoming . .	11,975	671	718	3,730	273,625	140,225	567
Total, 1880	10,357,488	1,812,808	993,841	12,443,120	22,488,550	35,192,074	47,681,700
Total, 1870	7,145,370	1,125,415	1,319,271	8,935,332	13,566,005	28,477,951	25,134,569
Total, 1860	6,249,174	1,151,148	2,254,911	8,585,735	14,779,373	22,471,275	33,512,867

TOTAL COTTON PRODUCTION AND AVERAGE PRODUCT PER ACRE.

From the Tables of the Tenth Census, 1880.

STATES, IN ORDER OF PRODUCTION.	POPULATION.			COTTON PRODUCTION.	
	Total.....	White....	Colored..	Acres..	Bales....
1. Mississippi	1,131,592	479,371	652,221	2,093,330	955,808
2. Georgia	1,542,180	816,906	725,274	2,617,138	814,441
3. Texas	1,592,574	1,197,499	395,076	2,173,732	803,642
4. Alabama	1,262,505	662,185	600,320	2,330,086	699,654
5. Arkansas	802,525	591,531	210,994	1,042,976	608,256
6. South Carolina	995,577	391,105	604,472	1,364,249	522,548
7. Louisiana	939,946	454,954	484,992	864,787	508,569
8. North Carolina	1,399,750	867,242	532,508	893,153	389,598
9. Tennessee	1,542,463	1,139,120	403,343	722,569	330,644
10. Florida	269,493	142,605	126,888	245,595	54,997
11. Missouri	2,168,804	2,023,568	145,236	32,711	19,733
12. Indian Territory				35,000	17,000
13. Virginia	1,512,565	880,858	631,707	24,000	11,000
14. Kentucky	1,648,690	1,377,179	271,511	2,667	1,367
Total	16,808,664	11,024,123	5,784,541	14,441,993	5,737,257
STATES.	AVERAGE PRODUCT PER ACRE IN POUNDS.				TOTAL IN TONS.
	Fraction of bale (47½ lbs.)	Seed-cotton..	Lint.....	Cotton-seed....	Lint..... Cotton-seed....
Mississippi	0.46	651	217	434	227,004 454,009
Georgia	0.31	444	148	296	193,430 386,859
Texas	0.37	528	176	352	190,865 381,730
Alabama	0.30	429	143	286	166,168 332,336
Arkansas	0.58	831	277	554	144,461 288,922
South Carolina	0.38	546	182	364	124,105 248,210
Louisiana	0.59	837	279	558	120,785 241,570
North Carolina	0.44	621	207	414	92,530 185,059
Tennessee	0.46	651	217	434	78,528 157,056
Florida	0.22	318	106	212	13,062 26,124
Missouri	0.60	861	287	574	4,687 9,373
Indian Territory	0.49	693	231	462	4,037 8,075
Virginia	0.46	654	218	436	2,612 5,225
Kentucky	0.51	729	243	486	325 649
Total	0.40	567	189	378	1,362,599 2,725,197

HIGHEST AND LOWEST PRICE OF COTTON PER POUND IN N. Y. FOR 42 YEARS.

Year.	L. H.	Year.	L. H.	Year.	L. H.	Year.	L. H.	Year.	L. H.	Year.	L. H.	Year.	L. H.
	Cts.		Cts.		Cts.		Cts.		Cts.		Cts.		Cts.
1839 .	11 16	1846 .	6 9	1853 .	10 11	1860 .	10 11	1867 .	15 36	1874 .	15 19		
1840 .	8 10	1847 .	7 12	1854 .	8 10	1861 .	11 28	1868 .	16 33	1875 .	13 17		
1841 .	9 11	1848 .	5 8	1855 .	7 11	1862 .	20 68	1869 .	25 35	1876 .	11 13		
1842 .	7 9	1849 .	6 11	1856 .	9 12	1863 .	54 88	1870 .	15 26	1877 .	11 13		
1843 .	5 8	1850 .	11 14	1857 .	13 15	1864 .	72 1 90	1871 .	15 25	1878 .	9 12		
1844 .	5 9	1851 .	8 14	1858 .	9 13	1865 .	33 1 22	1872 .	18 25	1879 .	9 13		
1845 .	4 9	1852 .	8 10	1859 .	11 12	1866 .	32 52	1873 .	13 21	1880 .	11 13		

TOBACCO PRODUCTION OF ALL THE STATES.

From the Tenth Census of the United States, 1880.

STATES AND TERRITORIES.	Acres.	Pounds.	STATES AND TERRITORIES.	Acres.	Pounds.
Alabama	2,197	452,426	Missouri	15,521	12,015,657
Arizona	1	600	Nebraska	101	57,979
Arkansas	2,064	970,220	Nevada	2	1,500
California	84	73,317	New Hampshire	88	170,843
Connecticut . . .	8,666	14,044,652	New Jersey . . .	152	172,315
Dakota	5	1,897	New Mexico . . .	7	890
Delaware	4	1,278	New York	4,937	6,481,431
Dist. Columbia .	2	1,400	North Carolina .	57,208	26,986,213
Florida	90	21,182	Ohio	34,676	34,735,235
Georgia	971	228,590	Oregon	43	17,325
Idaho	2	400	Pennsylvania . .	27,566	36,943,272
Illinois	5,612	3,935,825	Rhode Island . .	2	785
Indiana	11,955	8,872,842	South Carolina .	169	45,678
Iowa	692	420,477	Tennessee . . .	41,532	29,365,052
Kansas	333	191,669	Texas	685	221,283
Kentucky	226,120	171,120,784	Vermont	84	131,432
Louisiana	253	55,954	Virginia	140,791	79,988,868
Maine	1	250	Washington . . .	8	6,930
Maryland	38,174	26,082,147	West Virginia .	4,071	2,296,146
Massachusetts . .	3,358	5,369,436	Wisconsin	8,810	10,608,423
Michigan	170	83,969			
Minnesota	163	69,922			
Mississippi . . .	1,471	414,663			
			Total U. States	638,841	472,661,159

STATEMENT OF THE TOBACCO CROP OF THE UNITED STATES FOR 1879,

IN THE SEVERAL STATES PRODUCING IT AS A STAPLE, SHOWING ACREAGE, PRODUCTION, VALUE OF CROP IN FARMERS' HANDS, VALUE PER POUND, VALUE PER ACRE, AND COST OF PRODUCTION PER POUND.

From the Tenth Census of the United States, 1880.

RANK.			STATES.	Acreage.	Production. Pounds.	Value of Crop Dollars.	Value per Acre Dollars.	Value per 100 lbs. . . . Dollars.	Cost of pro- duction per 100 lbs. Dollars.
Produce- tion	Acres.	Total Value.							
1	1	1	Kentucky . .	226,120	171,120,784	11,089,782	49 04	6 48	4 90
2	2	2	Virginia . .	140,791	79,988,868	5,406,744	38 40	6 75	5 33
3	7	3	Pennsylvania	27,566	36,943,272	4,612,894	167 33	12 48	8 42
4	6	5	Ohio	34,676	34,735,235	2,653,234	76 51	7 63	5 91
5	4	8	Tennessee . .	41,532	29,365,052	1,538,757	37 04	5 24	4 50
6	3	4	N. Carolina .	57,208	26,986,213	3,805,089	66 51	14 10	9 33
7	5	7	Maryland . .	38,174	26,082,147	1,825,750	47 82	7 00	5 91
8	11	6	Connecticut .	8,666	14,044,652	1,929,982	222 70	13 74	9 85
9	8	12	Missouri . .	15,521	12,015,657	600,256	38 67	4 99	3 58
10	10	9	Wisconsin . .	8,810	10,608,423	899,118	102 05	8 47	4 95
11	9	13	Indiana . . .	11,955	8,872,842	443,642	37 10	5 00	3 60
12	13	10	New York . .	4,937	6,481,431	720,868	146 01	11 12	8 00
13	15	11	Massachus'tts	3,358	5,369,436	683,575	203 56	12 73	9 72
14	12	14	Illinois . . .	5,612	3,935,825	202,745	36 12	5 15	4 17
15	14	15	W. Virginia .	4,071	2,296,146	170,374	41 85	7 42	6 00
16	17	16	Arkansas . .	2,064	970,220	41,547	20 12	4 28	2 70
			Total . . .	631,061	469,816,203	36,624,357	. . .	. . .	. . .

CITIZENSHIP, WITH THE TOTAL MALE POPULATION, 1880.

From the Official Returns of the Tenth Census, 1880.

STATES AND TERRITORIES.	POPULATION.			VOTING POPULATION. Males of 21 years and over.		
				White.		Colored.
	Total.	White.	Colored.	Native in the U. States.	Foreign Born.	
Alabama . . .	1,262,505	662,185	600,320	136,058	5,403	118,423
Arizona . . .	40,440	35,160	5,280	9,790	8,256	2,352
Arkansas . . .	802,525	591,531	210,994	129,675	6,475	46,827
California . . .	864,694	767,181	97,513	135,209	127,374	66,809
Colorado . . .	194,327	191,126	3,201	65,215	26,873	1,520
Connecticut . .	622,700	610,769	11,931	118,747	55,012	3,532
Dakota . . .	135,177	133,147	2,030	25,476	25,486	641
Delaware . . .	146,608	120,160	26,448	27,447	4,455	6,396
Dist. Colum. . .	177,624	118,006	59,618	23,764	8,191	13,918
Florida . . .	269,493	142,605	126,888	30,351	3,859	27,489
Georgia . . .	1,542,180	816,906	725,274	172,044	5,923	143,471
Idaho . . .	32,610	29,013	3,597	7,331	4,338	3,126
Illinois . . .	3,077,871	3,031,151	46,720	505,272	277,889	13,686
Indiana . . .	1,978,301	1,938,798	39,503	414,252	73,446	10,739
Iowa . . .	1,624,615	1,614,600	10,015	287,530	126,103	3,025
Kansas . . .	996,096	952,155	43,941	201,354	53,595	10,765
Kentucky . . .	1,648,690	1,337,179	271,511	287,362	30,217	58,642
Louisiana . . .	939,946	454,954	484,992	81,777	27,033	107,977
Maine . . .	648,936	646,852	2,084	164,173	22,486	664
Maryland . . .	934,943	724,693	210,250	144,586	38,936	48,584
Massachusetts .	1,783,085	1,763,782	19,303	326,002	170,690	5,956
Michigan . . .	1,636,937	1,614,560	22,377	285,469	176,088	6,130
Minnesota . . .	780,773	776,884	3,889	88,622	123,777	1,086
Mississippi . .	1,131,597	479,398	652,199	102,580	5,674	130,278
Missouri . . .	2,168,380	2,022,826	145,554	396,322	111,843	33,042
Montana . . .	39,159	35,385	3,774	12,162	7,474	1,908
Nebraska . . .	452,402	449,764	2,638	83,334	44,864	844
Nevada . . .	62,266	53,556	8,710	11,442	14,191	5,622
N. Hampshire .	346,991	346,229	762	88,790	16,111	237
New Jersey . .	1,131,116	1,092,017	39,099	190,656	99,309	10,670
New Mexico . .	119,565	108,721	10,844	26,423	4,558	3,095
New York . . .	5,082,871	5,016,022	66,849	852,094	536,598	20,059
N. Carolina . .	1,399,750	867,242	532,508	187,637	2,095	105,018
Ohio . . .	3,198,062	3,117,920	80,142	613,485	191,386	21,706
Oregon . . .	174,768	163,075	11,693	38,006	13,630	7,993
Pennsylv'a . .	4,282,891	4,197,016	85,875	797,532	272,860	23,892
R. Island . . .	276,531	269,939	6,592	47,904	27,108	1,886
S. Carolina . .	995,577	391,105	604,472	82,910	3,990	118,883
Tennessee . . .	1,542,359	1,138,831	403,528	240,939	9,116	80,250
Texas . . .	1,591,749	1,197,237	394,512	246,018	55,719	78,639
Utah . . .	143,963	142,423	1,540	13,795	18,283	695
Vermont . . .	332,286	331,218	1,068	77,774	17,533	314
Virginia . . .	1,512,565	880,858	631,707	198,277	7,971	128,257
Washington . .	75,116	67,199	7,917	15,858	8,393	3,419
W. Virginia . .	618,457	592,537	25,920	123,569	9,208	6,384
Wisconsin . . .	1,315,497	1,309,618	5,879	149,460	189,469	1,550
Wyoming . . .	20,789	19,437	1,352	6,042	3,199	939
Total . . .	50,155,783	43,402,970	6,580,793	8,270,518	3,072,487	1,487,344

CROPS OF PRINCIPAL CEREALS IN THE UNITED STATES, 1870-1880.

Condensed from the Reports of the Commissioner of Agriculture.

1. Indian Corn.						
YEARS.	Bushels.	Acres.	Value.	Average yield per acre.	Average price.	Average value per acre.
			Dollars.	Bushels.	Cents.	Dollars.
1870	1,094,255,000	38,646,977	601,839,030	28.3	54.9	15 57
1871	991,898,000	34,091,137	478,275,900	29.1	48.2	14 02
1872	1,092,719,000	35,526,836	435,149,290	30.7	39.8	12 24
1873	932,274,000	39,197,148	447,183,020	23.8	48.0	11 41
1874	850,148,500	41,036,918	550,043,080	20.7	64.7	13 40
1875	1,321,069,000	44,841,371	555,445,930	29.4	42.0	12 38
1876	1,283,827,500	49,033,364	475,491,210	26.1	37.0	9 69
1877	1,342,558,000	50,369,113	480,643,400	26.6	35.8	9 54
1878	1,388,218,750	51,585,000	441,153,405	26.9	31.8	8 55
1879	1,547,901,790	53,085,450	580,486,217	29.2	37.5	10 93
Total 10 years	11,844,869,540	437,413,314	5,045,710,482	. .	. .	. .
Ann'l average	1,184,486,954	43,741,331	504,571,048	27.0	43.9	11 77
2. Wheat.						
					Dollars.	
1870	235,884,700	18,992,591	245,865,045	12.4	1 04.2	12 94
1871	230,722,400	19,943,893	290,411,820	11.5	1 25.8	14 56
1872	249,997,100	20,858,359	310,180,375	11.9	1 24.0	14 87
1873	281,254,700	22,171,676	323,594,805	12.7	1 15.0	14 50
1874	308,102,700	24,967,027	291,107,895	12.3	94.4	11 66
1875	292,136,000	26,381,512	294,580,990	11.0	1 00.0	11 16
1876	289,356,500	27,627,021	300,259,300	10.4	1 03.7	10 86
1877	365,094,800	26,193,407	395,155,375	13.9	1 08.2	15 08
1878	420,122,400	32,108,560	826,346,424	13.1	77.7	10 16
1879	448,756,630	32,545,950	497,030,142	13.8	1 10.8	15 27
Total 10 years	3,121,427,930	251,789,996	3,774,532,171	. .	. .	. .
Ann'l average	312,142,793	25,178,999	377,453,217	12.3	1 06.3	13 10
3. Oats.						
					Cents.	
1870	247,277,400	8,792,395	107,136,710	28.1	43.3	12 18
1871	255,743,000	8,365,809	102,570,030	30.5	40.1	12 26
1872	271,747,000	9,000,769	91,315,710	30.1	33.6	10 14
1873	270,340,000	9,751,700	101,175,750	27.7	37.4	10 37
1874	240,369,000	10,897,412	125,047,530	22.0	52.0	11 47
1875	354,317,500	11,915,075	129,499,930	29.7	36.5	10 86
1876	320,884,000	13,358,908	112,865,900	24.0	35.1	8 44
1877	406,394,000	12,826,148	118,661,550	31.6	29.2	9 25
1878	413,578,560	13,176,500	101,945,830	31.4	24.6	7 74
1879	363,761,320	12,683,500	120,533,293	28.7	33.1	9 50
Total	3,144,411,780	110,768,216	1,110,752,234	. .	. .	. .
Ann'l average	314,441,178	11,076,821	111,075,223	28.3	36.4	10 22

CROPS OF PRINCIPAL CEREALS—Continued.

4. Miscellaneous.

YEARS.	Bushels.	Acres.	Value.	Average yield per acre.	Average price.	Average value per acre.
BARLEY—			Dollars.	Bushels.	Cents.	Dollars.
Ann. av., 10 years .	33,704,652	1,529,357	24,885,502	21.9	74.7	16 35
RYE—						
Ann. av., 10 years .	18,460,985	1,305,060	12,945,136	14.0	71.9	10 05
BUCKWHEAT—						
Ann. av., 10 years .	9,747,271	551,104	6,972,974	17.5	71.6	12 74
POTATOES—						
Ann. av., 1870-79 .	132,837,174	1,514,044	73,653,771	87.8	56.7	50 05
HAY—				Tons.		
Crop of 1879, tons .	35,493,000	27,489,991	330,804,494	1.29	\$9 32	12 04
COTTON—				Lbs.	Cents.	
Crop of 1879, bales .	5,261,202	12,595,500	242,140,957	188	10.2	19 22
TOBACCO—						
Crop of 1879, lbs. .	391,278,350	492,100	22,727,524	795	5.8	46 18

AVERAGE CASH VALUE PER ACRE OF PRINCIPAL FARM CROPS, 1880.

From the Report of the Commissioner of Agriculture for 1879.

STATES.	Average value per acre.	STATES.	Average value per acre.	STATES.	Average value per acre.
Alabama	\$13 49	Maine	\$13 51	Oregon	\$17 11
Arkansas	20 40	Maryland	17 82	Pennsylvania . .	17 68
California	17 18	Massachusetts . .	26 71	Rhode Island . .	29 32
Connecticut . . .	16 82	Michigan	18 96	South Carolina .	10 09
Delaware	15 80	Minnesota	10 29	Tennessee	12 39
Florida	8 52	Mississippi	14 76	Texas	14 69
Georgia	10 35	Missouri	10 78	Vermont	11 69
Illinois	12 47	Nebraska	8 60	Virginia	10 91
Indiana	14 66	New Hampshire . .	13 56	West Virginia . .	12 74
Iowa	8 88	New Jersey	18 05	Wisconsin	13 80
Kansas	9 11	New York	14 15	Nevada, Colorado,	
Kentucky	13 58	North Carolina . .	10 79	and the Terri-	
Louisiana	22 40	Ohio	15 58	tories	16 13

SUGAR PRODUCT OF LOUISIANA, 1832-1880.*

YEARS.	Hogsheads.	YEARS.	Hogsheads.	YEARS.	Hogsheads.	YEARS.	Hogsheads.
1832 . .	70,000	1844 . .	200,000	1856 . .	73,296	1869 . .	87,000
1833 . .	75,000	1845 . .	186,000	1857 . .	279,697	1870 . .	144,881
1834 . .	100,000	1846 . .	140,000	1858 . .	362,296	1871 . .	128,461
1835 . .	30,000	1847 . .	240,000	1859 . .	221,840	1872 . .	108,520
1836 . .	70,000	1848 . .	220,000	1860 . .	228,753	1873 . .	89,498
1837 . .	65,000	1849 . .	247,923	1861 . .	459,410	1874 . .	116,867
1838 . .	70,000	1850 . .	211,201	1863 . .	76,801	1875 . .	144,146
1839 . .	115,000	1851 . .	236,547	1864 . .	10,387	1876 . .	169,331
1840 . .	87,000	1852 . .	321,934	1865 . .	18,070	1877 . .	127,753
1841 . .	90,000	1853 . .	449,324	1866 . .	41,000	1878 . .	213,221
1842 . .	140,000	1854 . .	346,635	1867 . .	37,647	1879 . .	169,972
1843 . .	100,000	1855 . .	231,427	1868 . .	84,256	1880 . .	218,314

The average weight of the hogshead is reckoned at 1,137 lbs. net.

* Bouchereau's statement.

AREA OF THE STATES AND TERRITORIES OF THE UNITED STATES.

STATES AND TER- RITORIES.	Sq. miles.	Acres.	STATES AND TER- RITORIES.	Sq. miles.	Acres.
N. Hampshire. .	9,280	5,939,200	Michigan . . .	56,451	36,128,640
Massachusetts. .	7,800	4,992,000	Florida	59,268	37,931,520
Rhode Island . .	1,306	835,840	Iowa	55,045	35,228,800
Connecticut . . .	4,750	3,040,000	Texas	274,356	175,587,840
New York	47,000	30,080,000	Wisconsin . . .	53,924	34,511,360
New Jersey . . .	8,320	5,324,800	California . . .	157,801	100,992,640
Pennsylvania . .	46,000	29,440,000	Minnesota . . .	85,531	54,739,840
Delaware	2,120	1,356,800	Oregon	95,274	60,975,360
Maryland	11,126	7,120,640	Kansas	80,891	51,770,240
Virginia	38,348	24,542,720	W. Virginia . .	23,000	14,720,000
North Carolina .	50,704	32,450,560	Nevada	112,090	71,737,600
South Carolina .	34,000	21,760,000	Nebraska	75,995	48,636,800
Georgia	58,000	37,120,000	Colorado	104,500	66,880,000
Kentucky	37,680	24,115,200	New Mexico . .	121,201	77,568,640
Vermont	10,212	6,151,680	Utah	84,476	54,064,640
Tennessee	45,600	29,184,000	Washington . .	69,994	44,796,160
Ohio	39,964	25,576,960	Dakota	150,932	96,596,480
Louisiana	41,346	26,461,440	Arizona	113,916	72,906,304
Indiana	33,809	21,637,760	Idaho	86,294	55,228,160
Mississippi	47,156	30,179,840	Montana	143,776	92,016,640
Illinois	55,414	35,464,960	Wyoming	97,883	62,645,120
Alabama	50,722	32,462,080	Indian Ter. . . .	68,991	44,154,240
Maine	35,000	22,400,000	Dist. Columbia	64	41,060
Missouri	65,350	41,824,000	Alaska	580,107	365,529,600
Arkansas	52,198	33,406,720			

RELATIVE NUMBER OF PLANTS OR HILLS IN AN ACRE.

Giving Number in an Acre when the Direct and Cross Rows are of Equal or Unequal Width.

In.	10 in.	12 in.	15 in.	18 in.	20 in.	2 ft.	2½ ft.	3 ft.	3½ ft.	4 ft.	4½ ft.	5 ft.
10	62726											
12	52272	43560										
15	41817	34848	27878									
18	34848	29040	23232	19360								
20	31362	26136	20908	17424	15681							
24	26132	21780	17424	14520	13068	10890						
30	20908	17424	13939	11616	10454	8712	6969					
36	17424	14520	11616	9680	8712	7260	5808	4840				
42	14935	12446	9953	8297	7467	6223	4976	4148	3565			
48	13068	10890	8712	7260	6534	5445	4356	3630	3111	2722		
54	11616	9680	7744	6453	5308	4840	3872	3226	2767	2420	2151	
60	10454	8712	6969	5808	5227	4356	3484	2004	2489	2178	1936	1742

AREA OCCUPIED BY THE PRINCIPAL CROPS OF THE UNITED STATES.

CROP.	Acres.	Quantities.	Sq. miles.	Relative Area.
Corn.	53,585,401	1,754,861,535 bush.	80,294	<div></div>
Wheat.	32,545,899	459,479,505 bush.	50,852	<div></div>
Hay	27,484,873	35,492,830 tons.	42,945	<div></div>
Oats	12,683,490	407,858,999 bush.	19,818	<div></div>
Cotton	12,595,510	5,737,257 bales.	19,680	<div></div>
Barley	2,680,750	44,113,495 bush.	4,188	<div></div>
Potatoes	1,836,820	181,369,340 bush.	2,854	<div></div>
Rye	1,625,440	19,831,595 bush.	2,539	<div></div>
Buckwheat. . . .	642,210	11,817,327 bush.	1,000	<div></div>

DURATION OF ANIMAL LIFE.

NAME.	Gestation or Incubation in months.	Length of Life in years.	NAME.	Gestation or Incubation in days.	Length of Life in years.
Elephant	20½	200	Swine	115	25
Whale	14	100	Lion	108	65
Giraffe	14	..	Wolf	63	16
Camel	12	50	Dog	63	16
Dromedary . . .	12	45	Fox	63	16
Horse	11	20	Cat	55	15
Ass	11	25	Rabbit	30	7
Tapir	10½	..	Kangaroo	29	..
Bison	9	20	Squirrel	28	7
Rhinoceros . . .	9	20	Opossum	18	..
Cow	9	20	Swan	42	100
Reindeer	8	16	Eagle . . . . .	..	100
Bear	6	20	Goose	30	80
Sheep	5	10	Turkey	30	..
Goat	5	12	Duck	28	..
Llama . . . . .	..	15	Hen	21	16
Chamois . . . .	..	25	Pigeon	18	15

RELATIVE VALUES AND WEIGHTS OF WOODS.

NAME.	Val.*	Weight.†	NAME.	Val.*	Weight.†
Shellbark Hickory	100	4,469	Hard Maple	60	2,878
Pignut Hickory	95	4,241	White Elm	58	2,592
White Oak	81	3,821	Sweet-gum	57	2,834
Western Hickory	81	3,705	American Holly	57	2,631
White Ash	77	3,450	Large Magnolia	56	2,704
Post Oak	74	3,464	Red Cedar	56	2,525
Barren Scrub Oak	73	3,339	Wild Cherry	55	2,668
Pin Oak	71	3,339	Soft Maple	54	2,668
Scrub Black Oak	71	3,254	Yellow Pine	54	2,463
Apple	70	3,115	Yellow Poplar	52	2,516
Red Oak	69	3,254	Spanish Oak	52	2,449
Sour-gum	67	3,142	Sycamore	52	2,391
White Beech	65	3,236	American Chestnut	52	2,333
Black Walnut	65	3,044	Butternut	51	2,534
Black Birch	63	3,115	White Birch	48	2,369
Rock Chestnut Oak	61	3,030	Pitch Pine	43	1,906
Yellow Oak	60	2,919	White Pine	42	1,868

* That is, value for fuel, taking shellbark hickory at 100 as the standard.

† That is, of dry wood, in pounds avoirdupois per cord.

WEIGHT OF A BUSHEL OF PRODUCE.

The number of pounds in a bushel of the various articles of Produce varies somewhat in the different States. The majority, however, have adopted the following:

PRODUCE.	lbs.	PRODUCE.	lbs.	PRODUCE.	lbs.
Apples (dried)	28	Grass seed (blue) . .	14	Onions	57
Barley	43	Grass seed (clover) .	60	Peaches (dried) . . .	28
Buckwheat	42	Grass seed (timothy) .	45	Peas	60
Beans	60	Hemp seed	44	Potatoes	60
Beans (castor)	46	Indian corn	56	Rye	56
Coal (mineral)	80	Indian corn (in ear) .	68	Rye (meal)	50
Charcoal (hard wood) .	30	Indian corn (meal) .	50	Salt	50
Flaxseed	56	Oats	32	Wheat	60

INTEREST LAWS IN THE UNITED STATES.

Compiled from the Latest State and Territorial Statutes.

STATES AND TERRITORIES.	Legal Rate of Interest.	Rate allowed by Contract.	STATES AND TERRITORIES.	Legal Rate of Interest.	Rate allowed by Contract.
	per cent.	per cent.		per cent.	per cent.
Alabama	8	8	Missouri	6	10
Arizona	10	Any rate.	Montana	10	Any rate.
Arkansas	6	10	Nebraska	7	10
California	7	Any rate.	Nevada	10	Any rate.
Colorado	10	Any rate.	New Hampshire	6	6
Connecticut	6	6	New Jersey	6	6
Dakota	7	12	New Mexico	6	12
Delaware	6	6	New York	6	6
Florida	8	Any rate.	North Carolina	6	8
Georgia	7	Any rate.	Ohio	6	8
Idaho	10	18	Oregon	8	10
Illinois	6	8	Pennsylvania	6	6
Indiana	6	8	Rhode Island	6	Any rate.
Iowa	6	10	South Carolina	7	Any rate.
Kansas	7	12	Tennessee	6	6
Kentucky	6	8	Texas	8	12
Louisiana	5	8	Utah	10	Any rate.
Maine	6	Any rate.	Vermont	6	6
Maryland	6	6	Virginia	6	8
Massachusetts	6	Any rate.	Washington Ter'y	10	Any rate.
Michigan	7	10	West Virginia	6	6
Minnesota	7	12	Wisconsin	7	10
Mississippi	6	10	Wyoming	12	Any rate.

COMPOUND INTEREST TABLE.

Showing the Amount of \$1.00 at Various Rates, Interest Compounded Annually, from One to Twenty Years.

Yrs.	3 per cent.	4 per cent.	5 per cent.	6 per cent.	7 per cent.	8 per cent.	9 per cent.	10 per cent.
1	1.030000	1.040000	1.050000	1.060000	1.070000	1.080000	1.090000	1.100000
2	1.060900	1.081600	1.102500	1.123600	1.144900	1.166400	1.188100	1.210000
3	1.092727	1.124864	1.157625	1.191016	1.225043	1.269712	1.295029	1.331000
4	1.125509	1.169859	1.215506	1.262477	1.310796	1.360489	1.411582	1.464100
5	1.159274	1.216653	1.276282	1.338226	1.402552	1.469328	1.538624	1.610510
6	1.194052	1.265319	1.340096	1.418519	1.500730	1.586874	1.677100	1.771561
7	1.229874	1.315932	1.407100	1.503630	1.605781	1.713824	1.828039	1.948717
8	1.266770	1.368569	1.477455	1.593848	1.718186	1.850930	1.992563	2.143589
9	1.304773	1.423312	1.551328	1.689479	1.838459	1.999005	2.171893	2.357948
10	1.343916	1.480244	1.628895	1.790848	1.967151	2.158925	2.367364	2.593742
11	1.384234	1.539454	1.710339	1.898299	2.104852	2.331639	2.580426	2.853117
12	1.425761	1.601032	1.795856	2.012197	2.252192	2.518170	2.812665	3.138428
13	1.468534	1.665074	1.885649	2.132928	2.409845	2.719624	3.065805	3.452271
14	1.512590	1.731676	1.979932	2.260904	2.578534	2.937194	3.341727	3.797498
15	1.557967	1.800944	2.078928	2.396558	2.759031	3.172169	3.642482	4.177248
16	1.604706	1.872981	2.182875	2.540352	2.952164	3.425943	3.970306	4.594973
17	1.652848	1.947901	2.292018	2.692773	3.158815	3.700018	4.327633	5.054470
18	1.702433	2.025817	2.406619	2.854339	3.379932	3.996019	4.717120	5.559917
19	1.753506	2.106849	2.526950	3.025600	3.616527	4.315701	5.141661	6.115909
20	1.806111	2.191123	2.653298	3.207136	3.869684	4.660957	5.604411	6.727500

MISCELLANEOUS.

CLASSIFICATION OF SOILS.

THE great quantity of sand in most soils, and its presence in all, have suggested the propriety of classifying soils according to the amount of sand they contain, as follows:

1. *Pure clay*, from which no sand can be removed by washing.
2. *Strong clay*, when the soil contains from 5 to 29 per cent of sand.
3. *Clay loam*, when it contains from 20 to 40 per cent of sand.
4. *Loam*, from 40 to 70 per cent of sand.
5. *Sandy loam*, from 70 to 90 per cent of sand.
6. *Light sand*, more than 90 per cent of sand.
7. *Calcareous* (or marly) soils are those which contain a large amount of calcium carbonate.

8. *Peaty soils* (vegetable mold) are those showing a large percentage of organic matter.

9. *Heavy*, the presence of a large quantity of clay makes a soil sticky when wet, and causes it to hold moisture a long time; hence such soils are said to be heavy. A large quantity of sand gives the opposite property—that is, of not retaining moisture—and hence these are said to be light.

The *soil proper* is the surface layer down to where a change in the character of the material takes place, generally from six to ten inches, and beneath this is the subsoil.

COMPARISON OF THE MEASURES OF CAPACITY.

One gallon or 4 quart wine measure contains 231 cubic inches.

One-half peck or 4 quart dry measure contains 268 4-5 cubic inches.

One gallon or 4 quart beer measure contains 282 cubic inches.

One bushel dry measure contains 2150½ cubic inches.

MEASUREMENTS OF CIRCLES.

To Find the Diameter.—Divide the circumference by 3.1416, and the quotient will be the diameter.

To Find the Circumference.—Multiply the diameter (which is double the radius) by 3.1416.

To Find the Area.—Multiply the square of the diameter by the decimal .7854; or multiply the square of the circumference by .07958; or multiply half the circumference by the decimal half. In either case the product will be the area in square roots of the denomination of the multiplicand.

To Find the Solidity (or Solid Contents) of a Sphere.—Multiply the cube of the diameter by the decimal .5236, and the production will be the solidity.

To Find the Side of an Equal Square containing the Same Area as a Given Circle.—The square root of area will be the side of the equal square.

MEASURES OF AN ACRE PLOT.

Either of the following measures include about an acre plot:

3 by 53 1-8 rods.	8 by 20 rods.
4 by 40 "	9 by 17 7-8 rods.
5 by 32 "	10 by 16 "
6 by 26 2-3 "	11 by 14 6-11 "
7 by 22 6-7 "	12 by 13 1-3 "

12 rods, 10 feet, and 8½ inches square make an acre.

SQUARE FEET AND FEET SQUARE IN FRACTIONS OF AN ACRE.

Frac'n of an acre.	Square feet.	Feet square.	Frac. of acre.	Square feet.	Feet square.
1-16	2722½	52½	¼	21780	147½
1-8	5445	73½	1	43560	208½
½	10890	104½	2	87120	295½
1-03	14520	120½			

TO MEASURE CISTERNS AND CASKS.

To Measure the Contents of Cisterns.—To ascertain the contents of circular cisterns, multiply the square of the diameter in feet by the depth in feet, and that product by $\frac{3.73}{2000}$ for the contents in hogsheads, or by $\frac{3.73}{2000}$ for barrels, or $\frac{1}{4}$ for the contents in gallons.

Square Cisterns.—Multiply the width in feet by the length in feet, and that by the depth in feet, and that again by $\frac{1.2}{160}$ for hogsheads, or $\frac{1.2}{160}$ for barrels, or $\frac{7.48}{160}$ for gallons.

Another and simpler method is to multiply together the length, width, and depth in inches, and divide by 231, which will give the contents in gallons.

TO MEASURE LAND.

If the field be a square or parallelogram, multiply the length in rods by the width in rods, and divide by 160, the number of square rods in an acre. If the field is triangular, multiply the length of the longest side in rods by the greatest width in rods, and divide half the product by 160. If the field be of irregular shape, divide it into triangles, and find the acreage of each triangle as above. All straight-sided fields can be thus measured. Where the sides are crooked and irregular, take the length in rods in a number of places at equal distances apart, add them, and divide by the number of measurements, which will give the mean length; proceed similarly with the width, multiply the mean length by the mean width, and divide by 160. Where the field is in a circle, find the diameter in rods, multiply the square of the diameter by 7.854, and divide by 160.

To Lay Out an Acre in Rectangular Form.—An acre of land contains 160 square rods, or 43,560 square feet. Hence, to lay out an acre at right angles (square corners), when one side is known, divide the units in the square content by the units of the same kind in the length of the known side. Thus: if the known

side be 4 rods, divide 160 by 4, and the quotient 40 will be the depth of the acre plot. If the length of the known side be 90 feet, divide 43,560 by 90, and the quotient 480 will be the depth of an acre plot.

MEASUREMENT OF HAY.

The only exact method of measuring hay is to weigh it; but the rules given below will be found sufficient for ordinary practical purposes.

To Find the Number of Tons of Hay in a Mow.—Multiply together the length, height, and width in yards, and divide by 15 if the hay be well packed. If the mow be shallow, and the hay recently placed therein, divide by 18, and by any number from 15 to 18, according as the hay is well packed.

To Find the Number of Tons of Hay in Square or Long Stacks.—Multiply the length of the base in yards by the width in yards, and that by half the height in yards, and divide by 15.

To Find the Number of Tons of Hay in a Load.—Multiply together the length, width, and height, in yards, and divide the product by 20.

To ascertain the value of a given number of pounds of hay, straw, or other commodity sold by the ton, at a given price per ton, multiply the number of pounds by one-half the price per ton, and point off three figures from the right. The result will be the price of the article.

TO MEASURE CORN.

To measure corn in a crib, multiply the length of the crib in inches by the width in inches, and that by the height of the corn in the crib in inches, and divide the product by 2,748, and the quotient will be the number of heaped bushels of ears. If the crib flares at the sides, measure the width at the top and also at the bottom, add the two sums together, and divide by two, which will give the mean width.

MEASUREMENT OF WOOD AND LUMBER.

A Cord of Wood contains 128 cubic feet. To ascertain how many cords there are in a pile of wood, multiply the length by the height, and that by the width, and divide the product by 128.

To ascertain the circumferences of a tree required to hew a stick or timber of any given number of inches square, divide the given side of the square by .225, and the quotient is the circumference required.

Round timber, when squared, loses one-fifth.

To measure round timber, take the girth in inches at both the large and small ends, add them, divide by 2, which gives the mean girth; then multiply the length in feet by the square of one-fourth of the mean girth, and the quotient will be the contents in cubic feet. This rule is commonly adopted, and gives four-fifths of the true contents, one-fifth being allowed to the purchaser for waste in sawing.

To Measure Inch Boards.—Multiply the length in feet by the width in inches, and divide the product by 12. The quotient will be the contents in feet. For lumber $1\frac{1}{2}$ inches thick, add $\frac{1}{4}$ to the quotient. If $1\frac{3}{4}$ inches thick, add $\frac{1}{2}$. If 2 inches thick, divide by 6 instead of by 12. If $2\frac{1}{4}$ inches thick, add $\frac{1}{4}$ to the quotient, and so on. If 3 inches thick, divide by 4. If 4 inches thick, divide by 3. If six inches thick, divide by 2. To ascertain the contents (broad measure) of timber, multiply the width in inches by the thickness in inches, and that by the length in feet, and divide the product by 12. The result will be the number of feet.

To ascertain how many feet of lumber can be sawed from a log, from the diameter of the log in inches subtract 4; one-fourth the remainder squared and multiplied by the length of the log in feet will give the correct amount of lumber that can be sawed from the log.

QUANTITY OF SEED OR PLANTS REQUIRED
PER ACRE.

Barley	2½ bush.
Beans, bush, in drill 2½ feet	1½ bush.
Beans, pole, Lima, 4 by 4 ft.	20 qts.
Beans, Carolina, 4 by 3	10 qts.
Beets, drills 2½ feet	9 lbs.
Broom-corn in drills	4 qts.
Cabbage, for transplanting	12 oz.
Cabbage sown in frames	4 oz.
Carrot, in drills 2½ feet	4 lbs.
Celery, seed	8 oz.
Celery, plants 4 by ½ feet	25,800 pl'ts.
Clover, white Dutch	12 lbs.
Clover, Lucerne	10 lbs.
Clover, Alsike	6 lbs.
Clover, red with timothy	6 lbs.
Clover, red without timothy	10 lbs.
Corn, sugar	10 qts.
Corn, field	4 to 6 qts.
Cucumber, in hills	2 qts.
Flax, broadcast	16 to 20 qts.
Grass, timothy, with clover	6 qts.
Grass, timothy, without clover	10 qts.
Grass, orchard	2 bush.
Grass, red-top or herds	10 qts.
Grass, blue	28 qts.
Grass, rye	20 qts.
Grass, millet	32 qts.
Hemp, broadcast	½ bush.
Lawn grass	35 lbs.
Melons, water, hills 8 by 8 ft.	3 lbs.
Oats	2 bush.
Onion, in rows for large bulbs	4 lbs.
Parsnip, in drills 2½ feet	5 lbs.
Pumpkins, in hills, 8 by 8 ft.	2 qts.
Peas, in drills, short varieties	1½ bush.
Peas, broadcast	3 bush.
Potatoes	5 to 8 bush.
Rye, broadcast	1½ bush.
Rye, drilled	1 bush.
Squash, running, 8 by 8 feet	2 lbs.
Sorghum	2 to 4 qts.
Turnips, in drills, 2 feet	3½ lbs.
Turnips, broadcast	1 lb.
Tomatoes, in frame	3 oz.
Tomatoes, in hills, 3 by 3 ft.	8 oz.
Tomatoes, plants	3,800 pl'ts.
Wheat, in drills	1½ bush.
Wheat, broadcast	1½ bush.

INDEX.

	PAGE.		PAGE.
ABERDEEN-ANGUS, Galloway or		Barn-yard Manure.....	103
Polled Cattle.....	749	Barrel chair.....	426
Adaptation for farm-work, of in-		Barrel coop.....	432
dividuals	19	Barrel Sled	436
Adjustment of foods, Proper.....	1184	Barrel well-curb	416
Age, Feeding as influenced by...	1189	Barrow for stable use.....	436
Albuminoid ratio of foods.....	1178	Barrow ladder.....	419
Alderney Cattle.....	765	Bean weevil.....	329
Alfalfa	131	Beans in garden.....	295
Alsike Clover.....	130	Pole-beans	295
Amount of Food supplied, In-		Beans, their varieties.....	192
creasing.....	1183	Where to plant.....	192
Apiary (see Bees).....	1133	How much seed to the acre...	193
Apples in orchard.....	261	Harvesting and threshing.....	193
How far apart.....	261	Bees and bee culture.....	1133
Varieties.....	262	Apicultural journals.....	1133
Apple-tree Borer.....	343	Hindrances to the industry.....	1134
Army-worm.....	364	Requisites to success.....	1134
Artichokes.....	252	Natural history of Bees.....	1135
Asparagus and its cultivation....	293	The Queen.....	1135
Ass, The.....	673	Ovaries of.....	1136
Ayrshire cattle.....	761	Mating	1136
In the United States.....	764	The Drones.....	1136
		Organs of copulation.....	1137
BAG-HOLDER.....	434, 409	Drone cells.....	1137
Barley, Treatment of.....	189	Worker Bees.....	1139
Barn, The, and Barn-yard.....	1193	Races of Bees.....	1140
Plans of.....	1194	Black or German bee.....	1140
Lumber required.....	1196	Italian bee.....	1140
Approaches to.....	1197	Syrians	1141
Lean-to shed.....	1198	Cyprian bee.....	1141
Feeding shed and rack.....	1198	Products of bees.....	1141
Rack for stacking straw.....	1199	Honey.....	1141
Cow-stalls and manure ditch...	1200	Wax and comb.....	1141
Slatted floor.....	1201	Pollen or bee-bread.....	1141
Stanchions.....	1202	Propolis or bee-glue.....	1142
Barn-closet.....	434	Practical bee-keeping.....	1142

	PAGE.		PAGE.
Bees and Bee culture—		Beets and Mangold-wurzels.....	250
Of Hives and sections.....	1142	Soil, cultivation, and gathering	250
Langstroth hives.....	1142	Binding corn-fodder with rye-	
Sections.....	1147	straw.....	160
Frames and crates.....	1147	Blackberries.....	278
Location of an Apiary.....	1148	Blue-grass.....	120
Transferring.....	1149	Bommer's method with manures.	81
Feeding and feeders.....	1150	Bone-meal.....	111, 85
Queen-rearing.....	1152	Bonus given for good work.....	30
Clipping the queen's wings.....	1155	Borer, Apple-tree.....	343
Fertile workers.....	1155	Flat-headed.....	345
Uniting colonies.....	1156	Twig.....	347
Hiving a colony.....	1157	Borer, Currant.....	358
To prevent swarming.....	1157	Borer, Peach.....	354
How to Italianize.....	1158	Bran as a manure.....	83
To introduce a queen.....	1158	Broom-corn.....	194
Shipping cage.....	1159	Varieties.....	195
Shipping queens.....	1159	Soil best adapted to it.....	196
The Good candy for food.....	1159	Planting seed, and how much..	196
Shipping bees.....	1160	Harvesting.....	197
Extracting Honey.....	1160	Curing.....	198
Handling bees.....	1161	Preparing for market.....	199
Smoking bees.....	1162	Broom-corn scraper.....	409
Comb foundation.....	1162	Brooms, Making.....	199
Save the wax.....	1163	Buckwheat.....	200
Marketing honey.....	1164	Buckwheat as a green manure...	91
Honey plants.....	1164	Building Associations.....	377
Do bees attack grapes?.....	1166	Bushel Box.....	418
To winter bees.....	1167	Butter and Butter-making (see	
Spring dwindling.....	1169	Dairy).....	850
Diseases of Bees.....	1169	Butting Preventer.....	423
Dysentery.....	1169		
Foul Brood.....	1169	CABBAGES.....	296
Enemies of Bees.....	1170	Varieties.....	297
Beef-rack.....	416	Early plants.....	297
Beetles, Blister.....	340	Cabbage insects.....	298
Beetle, Colorado Potato.....	317	Storing cabbages.....	298
History.....	317	Cabbage Moths.....	337
Permanence.....	318	Cabbage Fly.....	338
Remedies against.....	319	Cabbage Leaf-roller.....	335
Enemies of.....	321	Cabbage-worm.....	334
Beetle, The May.....	324	Canker-worm.....	347
Beets.....	296	Capital in farming.....	28

	PAGE.		PAGE.
Carrots.....	251, 299	Cattle, Management of—	
Caterpillar, Tent.....	349	Labor-saving system of feeding	788
Fall web-worm.....	350	Feeding-box for shock-corn.....	789
Cattle, Breeds of—		Stall-feeding of cattle.....	789
Short-horns or “Durham”.....	738	Feeding Cattle: feed.....	790
Herefords.....	745	Stanchions.....	793
Aberdeen, etc.....	749	Stalls.....	794
Galloway (Aberdeen, etc.).....	749	Bedding.....	795
Polled (Aberdeen, etc.).....	749	Foddering in barn.....	796
Holstein.....	752	Feeding: whole corn, or meal?	797
Devon.....	755	Object of feeding: regularity...	798
Ayrshire.....	761	When to begin feeding.....	799
Jersey (Channel Islands).....	765	Grass and grain combined.....	800
Alderney (Channel Islands)...	765	Roots as feed.....	801
Guernsey (Channel Islands)...	765	Summer-feeding.....	802
Spanish.....	768	Examples of feeding given.....	803
Texan (Spanish).....	768	Cattle: Short-horn.....	738
Cattle, Diseases of.....	899-930	Celery.....	299
(See Index to, on p. 898.)		Cereal Productions of U. States,	
Cattle-feeding: Soiling and En-		Table of.....	1203
silage—		Chafer, Rose.....	363
What is soiling?.....	809	Chair and step-ladder combined..	427
Saving of land.....	810	Changing character of soil.....	99
Saving of fences.....	811	Channel Island Cattle.....	765
Extermination of weeds.....	812	Character of community.....	21
Saving of food.....	812	Cheese, Cheese-making and Cheese	
Saving of manure.....	812	Factories (see Dairy).....	854
Greater production of milk....	813	Chemistry of foods and feeding..	1171
Objections to soiling.....	814	Cherries.....	268
Who should soil?.....	816	Varieties.....	268
Soiling crops.....	818	Chinch-bug, remedies against....	331
Double cropping in soiling....	820	Chickens (see Poultry).....	1041
Cattle, Management of.....	770	Clay.....	98
Mistakes of stock-men.....	770	Climbing cut-worms.....	361
Raising calves.....	772	Closet in Barn.....	434
Fall calves.....	774	Clothes-line Lifter.....	425
Plan of J. G. Oxer.....	775	Clover as a manure.....	87
Pastures and grazing.....	778	Clover for fodder.....	129
Water supply.....	781	Clover in the orchard.....	261
Winter care of cattle.....	782	Codling Moth.....	341
Feeding for beef.....	786	Commercial fruit-growing.....	280
Different systems of feeding....	786	Commercial manures.....	110, 85
Profits of feeding.....	786	Condition of soil on farms.....	20

	PAGE.		PAGE.
Corn as a green manure.....	92	DAIRY, The : (Cattle)—	
Corn-cribs	164	Farm dairying.....	833
Corn-crop of the U. States (see		Selecting the cows.....	834
also Cereals)	140	Testing the milk.....	835
Average yield per acre.....	140	Breeds of cattle.....	836
Reports of corn-growers.....	141	“Gilt-edged” Butter	837
Corn-fodder and fodder-corn.....	158	Pastures and food	838
Cost of drainage.....	71	Full feeding profitable.....	840
Cost of fences	34	Milking	841
Cost of tillage to be considered		Milking tubes	842
in farming.....	28	How to manage the milk.....	843
Cottage, Farm.....	383	Deep can for milk	844
Cotton.....	203	Milk-house.....	845
Cultivation	204	Ice-house.....	846
Picking season.....	204	Ice-chest for milk-pans.....	848
Sorting	205	Bad flavor in butter, causes...	849
Ginning.....	205	Skimming	849
Baling.....	206	Skimmer for deep cans.....	850
Enemies of.....	206	Churns and churning.....	850
Cotton moth.....	206	Washing and working.....	852
Army-worm.....	207	Butter-worker	852
Boll-worm	207	Keeping butter.....	853
Diseases.....	208	Brining butter.....	854
Cotton Production in the U. S.,		Family cheese-making.....	854
table of.....	1204	Cheese-basket.....	855
Cotton-seed and its Uses.....	208	Cheese-ladder.....	855
Meal of.....	209	Rennet	855
Cotton-worm.....	364	Setting the milk—temperature.	856
Boll-worm	364	Applying the rennet.....	856
Crab for shocking corn.....	409	Handling the curd	856
Cream (see Dairy).....	862	Pressing the cheese.....	857
Crops, Rotation of.....	24	Curing	858
Cucumbers	302	The factory system, etc.....	858
Cucumber Beetles, striped.....	340	Milk for cheese.....	859
Culture of corn, hill and drill...	156	A good cow.....	859
Curculio, Plum.....	351	Maintenance.....	861
Curing clover-hay.....	134	Handling of milk.....	861
Currants	278	Modern invention.....	861
Currant Borer.....	358	Lowering temperature.....	862
Cutting grass for hay.....	127	Deep or shallow setting.....	862
Cut-worms	321	The centrifugal cream-separator	863
Cut-worms, climbing.....	361	Its superiority.....	864
Cut-worms, to keep from corn...	152	Noticeable results.....	865

	PAGE.		PAGE.
Dairy, The: (Cattle)—		Drainage, how it helps the soil.	101, 55
Associated dairying.....	865	Drainage lengthens the season....	58
The Patron cheese factory.....	866	Prevents winter freezing.....	59
Stock factory	866	When to drain	60
Milk-selling	867	Drains, Material used for	62
Private factories	867	Drying rack, Wheel.....	425
Different factory systems.....	867	Ducks (see Poultry).....	1103
Creamery, At a.....	868	Dumping sled	413
A full stock cheese.....	868	Dwarf Pears	265
Curing room, The	869		
Supply houses.....	870	EFFECT of farm products on fer-	
The exclusive creamery.....	870	tility	24
The general plan.....	870	Effect of manures on plants.....	80
Co-operative Creameries.....	871	Effect of wet and drained soils... 56	
A New System	872	English Bent grass.....	122
Creamery butter.....	872	English horses, when first used... 471	
The keeping of butter.....	874	Race-course, First.....	471
Working butter.....	874	Ensilage	821
Packing butter	874	Cost of.....	826
Sweet and sour cream butter... 874		Crops for	826
Gentle warnings	876	Experiments with.....	828
Wastes of the dairy	876	Evener for horse draught.....	415
Devons (Cattle).....	754	Exhaustion of soils.....	108
In the United States	758	Expenses of cultivation.....	27
Different foods.....	1173		
Digestibility of foods	1176	FALLOW	109
Digging the ditch for drains..... 69		Farm Products, Choice of.....	22
Diseases of Cattle.....899-930		Farm, Selection of	18
(See Index to, on p. 898.)		Farming a science.....	17
Diseases of Horses	689-737	Farms, how large.. ..	18
(See Index to, on p. 687.)		Farmer's horse.....	508
Diseases of Sheep (see Sheep)...1033		Fat	1171
Diseases of Swine (see Swine) ... 943		Fattening animals.....	1187
Distance apart of drains	64	Feed-box, Hinged.....	422
Ditches, Open	63	With handle.....	422
Door-yard, The.....	384	With cover.....	422
Double-bar plow	157	Feed cooker.....	414
Double-pivot gate.....	419	Feeding, Purposes of	1180
Draft horses	476	Fence rows.....	49
Dragging the soil: the drag..... 154		Fences.....	34
Drags, how made	154	Fences and walks about dwelling 391	
Drainage.....	54	Fences, Portable.....	47
Advantages of.....	54	Fermentation of manure.....	105

	PAGE.		PAGE.
Fertile soil, what constitutes.....	100	Fruit-growing, Commercial.....	280
Fertility of soils.....	93	Fruits on the farm.....	253
Fertilizers, Special	83	Fruits, Small (berries).....	272
Flat-headed Borer.....	345	Fruit-trees, Selection of.....	255
Flax	201		
Culture of.....	202	GALLOWAY cattle.....	749
Flea-beetle, Striped.....	336	Gardening and truck-farming.....	282
Grape.....	336	Garden reel.....	429
Flood-gates.....	50	Gate hung with weight.....	418
Fly, Hessian	326	Gates on farm	51
Fodder-corn.....	161, 158	Lift-gate.....	51
Food and manure.....	115	Hung on hinges.....	52
Foods and Feeding—		Geese (see Poultry)	1110
Starch and Sugar, Component		Gooseberry saw-fly	360
elements.....	1171	Gooseberries.....	279
Fat.....	1171	Grapes	269
Foods and their use	1172	Trellis for vines.....	269
Different use of food constit-		Wire trellis	270
uents.....	1172	Varieties.....	271
Different foods.....	1173	Grass-crop of the country.....	118
Comparative value of.....	1175	Grasses, Varieties of.....	120
Nutritive qualities.....	1176	Timothy	120
Digestibility.....	1176	Blue-grass.....	120
Albuminoid ratio.....	1178	Orchard grass	121
Water in foods	1180	Red-top	121
Purposes of feeding	1180	Meadow Foxtail.....	122
Reducing food of support.....	1181	Fowl Meadow grass	122
Increasing food of support.....	1183	Rough-stalked Meadow grass...	122
Proper adjustment of.....	1184	Perennial Rye grass	122
Ratio of food for young animals.	1185	English Bent Grass.....	122
Ratio of food for milk.....	1186	Meadow Fescue	122
Fattening animals.....	1187	Sweet-scented vernal grass.....	123
Feeding influenced by age.....	1189	Millet.....	129
Profitable feeding	1191	Clover	129
Foods, Comparative value of.....	1175	Alsike clover.....	130
Foods increasing manures	104	Lucern or Alfalfa.....	131
Food of support, Reducing.....	1181	White clover.....	131
Foot-scrapers	426	Red clover.....	132
Forests, Value of.....	367	Grass-seed, when to sow.....	125
Fountain-pump	343	Grass improving the soil	119
Fowl Meadow-grass.....	122	Green manures	107
French Draft-horse.....	480	Green manuring and manures.....	107, 86
French Horse, Ohio investigates.	483	Guano.....	112

	PAGE.		PAGE
Guernsey cattle.....	765	Horse, The—	
Gypsum.....	111	Lesson of History.....	453
HANGING rack for hogs.....	405	The Hebrew horse.....	454
Handy things about a farm.....	403	Greek.....	455
Harness clamp.....	435	Egypt, Improvement came from	456
Hay-feeding.....	126	Races instituted.....	457
Hay-gatherer.....	407	Endurance and docility sought.	457
Hay-hook.....	408	Olympian Races, Influence of..	458
Hay-making.....	126	Monument to a Mare.....	459
Hay, shrinkage of in barn.....	128	Southern European horses im-	
Hedges.....	37	proved.....	459
Herding Cattle—		Ideal Greek horse.....	460
Herding in Kansas.....	878	Roman horse.....	460
Elements of success.....	879	Inferior to the Greek.....	461
Experience of Herders.....	880	Arab horse.....	461
Herding, Method of.....	883	Origin of.....	463, 468
Selecting a Ranch.....	886	Barb, The.....	463
Fire-guards.....	888	Degraded with man.....	464
The best breed.....	890	Influence of Barb on other	
Land titles.....	891	horses.....	465
New beginners.....	892	Godolphin Arabian.....	466
Markets.....	893	Darley Arabian.....	466
Brands.....	894	Arab Mare as war-horse.....	468
Brand-chutes and Corrals.....	894	Unique character of.....	468
Castration.....	896	Thoroughbred, The.....	469
Opportunities for cattle-raising.	896	Arab element.....	470
Herefords, the (Cattle).....	745	Barb element.....	470
Hessian Fly.....	326	German element.....	470
Hinny, The.....	685	Spanish, Norman, and Flan-	
Hired help on farm.....	29	ders Blood.....	471
Hives for Bees (see Bees).....	1142	The Horse in Agriculture...	477
Hog-jack.....	405	Flanders element.....	477, 472
Hog loader.....	423	The Historic Trio.....	473
Hogs (see Swine).....	931	Stud-book, The.....	473
Hogs in the orchard.....	261	Climatic influence.....	474
Holstein cattle.....	752	Size and power sacrificed to	
Home and its surroundings, The.	378	speed.....	474
Honey (see Bees).....	1141	Soil and climate affect size...	479
Hoof-hook.....	436	Percheron.....	482
Horse, The.....	449	Flemish Blood.....	486
History of, Fossil.....	450	Norman name.....	486
Written History.....	451	French Blood in Canada and	
		New Jersey.....	487

	PAGE.		PAGE.
Horse, The—		Horse-breeding—	
French Horse in Ohio.....	487	Heredity.....	535
French Horse in Illinois.....	488	Atavism.....	535
Percheron Horse, Model for.	490	Pedigree, Value of.....	536
Percheron Mare, Model for..	491	Earliest records of.....	537
French Horse in motion.....	493	High breeding more than ap-	
Norman Horse again.....	493	pearance.....	537
Canadian Horses.....	495	Breeding back.....	538
Their origin.....	496	Breeding for color of Short-Horn	
Climate and environment.	497	cattle.....	538
English Draft.....	498	Breeding for color of Berkshire	
Effect of soil and climate..	500	swine.....	538
Heavy Black English.....	500	The law essential to improve-	
Points of English Dray...	501	ment.....	539
Scotch Draft.....	501	Breed for a special purpose....	539
Boulonnaise and Conestoga..	504	American farmers not careful	
Cleveland Bays.....	506	enough.....	539
Horse, the Farmer's.....	508	English farmers more careful..	540
Horse, Fast-trotting.....	511	Breeding for increased size.....	541
Early records of trotting.....	512	Increase size gradually.....	541
First trot for money in America	512	Breeding for docility.....	542
Trotting-clubs organize.....	512	Vice follows vice.....	542
Messenger Trotters.....	513	Work the breeders.....	543
Light vehicle introduced.....	514	Evils of confinement.....	543
Trotting ability discovered.....	515	Endurance may be increased...	544
Description of great sires:		Family trait important.....	544
Diomed.....	515	Effect of short race.....	544
Canada Trotters.....	517	In-and-in breeding.....	545
Mambrino family.....	518	Defects inheritable.....	545
Running Blood in Trotters....	519	Close breeding.....	545
Remarkable Trio.....	522	In-and-in breeding necessary...	546
Noted Double Teams.....	522	General principles of breeding.	546
Element of Running Blood...	523	Cross-breeding.....	550
Maud S.	524	Doubtful advantages.....	551
Horse-will near to stubbornness	525	Difficulties attending.....	552
Goldsmith Maid.....	525	Mania for out-crossing.....	552
Power of kindness.....	526	Grades better than crosses....	553
Dexter.....	526	Grade or cross-bred sires to be	
Hambletonians, The.....	527	avoided.....	553
The Russian Trotter.....	529	Large male and small female	
Horse-breeding.....	533	crossed.....	553
Jacob a color-specialist.....	533	Difficulties in parturition.....	554
Bakewell bred for quality.....	534	Uses of cross-breeding.....	554

PAGE.

Horse-breeding—

Influence of previous impregnation.....	555
Soundness of parents.....	556
Best age for breeding.....	557
The farmer as a breeder.....	557
Kind of mares for farmers.....	558
Inherited defect.....	558
Color of mare.....	559
Size of mare.....	559
A profitable mare.....	560
Relation of size in sire and dam.....	560
Choosing the stallion.....	561
Pedigree, then quality.....	562
Some defects may be corrected.....	562
The ideal farm-horse.....	563
A farmer's team of mares.....	564
How size may be increased.....	566
The stallion.....	567
Feminine-looking male.....	567
Influence of sire and dam.....	568
Importance of a quiet, sound mare.....	569
Temperament important.....	570
Condition at breeding time.....	571
Condition of sire and dam.....	572
At conception.....	573
After conception.....	573
Mare and stallion should be worked.....	573
A matter of economy.....	574
Mischief comes with idleness.....	574
Care of stallions.....	574
The two methods.....	575
Care of breeding mares.....	576
Effeminacy comes with idleness.....	576
Feed and care important.....	576
How to know a mare is with foal.....	577
Period of gestation.....	577
How to know foaling time.....	578
Treatment at foaling time.....	579
After foaling.....	579

PAGE.

Horse-breeding—

Care and feeding of colts.....	580
Abortion.....	581
Age to breed—(the Heifer)....	582
Age to bred—(the Sow).....	583
Age to breed—(the Mare).....	583
Aged brood-mares.....	584
Sex—Can it be controlled?....	584
Importance of first impregnation.....	587
Valuable Hints.....	590
Horse—Buying and selling.....	594
Why difficult.....	594
What is unsoundness?.....	594
Warranty.....	595
Definition of unsoundness.....	596
Vices and disabilities.....	597
The eyes.....	599
The feet.....	600
The limbs.....	601
Back and body.....	606
General hints to purchasers....	607
Points of a horse.....	610
Horse, Anatomy and Physiology of.....	611
The skeleton.....	611
Framework, an index of value.....	612
Muscular development.....	614
Physiology of muscle.....	615
The blood.....	616
Respiration.....	617
Digestion.....	617
Secretion and excretion.....	618
Nervous system.....	620
The foot.....	621
Mouth, and teeth at different ages.....	623
Irregularities of teeth.....	633
Diseases of teeth.....	633
Horses, Diseases of.....	689-737
See Index to, on p. 687.	
House, Dwelling, on farm.....	378
Location of.....	379

	PAGE.		PAGE.
House, Dwelling, on farm—		Hygiene and Sanitary conditions—	
Size of house lot.....	380	Labor and fatigue.....	657
Character of house.....	382	Feeding.....	658
Cottage, Elevation of.....	383	How to feed.....	659
Convenient farm-house.....	384	What to feed.....	660
Plans of farm-house.....	385	Economy in feeding.....	661
Hoven.....	139	Value of bulky food.....	662
How much to cultivate.....	24	Feeding corn-meal.....	664
How to get a home.....	397	Accumulated experience	665
Humus, or partially decayed veg-		Cost of keep	667
etable matter	98	Drink	667
Husking-table	408	Pure water.....	668
Hygiene and Sanitary conditions		Grooming for health.. ..	669
on farm.....	635	Condition Powders	670
Air	635	Hospital.....	671
Ventilation.....	636	The horse-blanket.....	672
Location of barns and stables..	637		
Bank barns	638	IMPORTANCE of wheat as a crop..	166
Light and pure air.....	639	Improvement of soils.....	107, 101
Impure air poisonous	639	Drainage.....	101
Warm stables.....	640	Cultivation.....	102
Temperature of stable.....	641	Manures.....	102
Size of stable.....	642	Injurious insects	316
Ventilators.....	642		
Sub-ventilators.....	643	JERSEY cattle, etc.....	765
Vitiated atmosphere a source of			
disease.....	643	KICKING, To cure, Method.....	424
Causes of disease	657, 644	Killing-post for fowls.....	410
The stable-floor.....	645	Kitchen and house-slops.....	394
Care of the feet.....	647		
Cleaning or grooming.....	647	LADDER, Barrow.....	419
Stalls.....	649	Self-supporting.....	419
Rack, or manger.....	650	Combined straight and step.....	420
Disinfectants.....	651, 656	Pole.....	420
Dry earth an absorbent and		Ladder for loading fodder.....	408
disinfectant.....	652	Lambs (see Sheep).....	1017
Artificial disinfectants.....	653	Land measurer.....	432, 415
Fresh lime.....	653	Lawn, House.....	389
Charcoal.....	654	Laying out drains.....	67
Chloride of zinc	654	Laying the tiles in drains.....	70
Chloride of lime	654	Less acreage tilled, the tillage	
Chlorine.....	654	more thorough.....	26
Carbolic acid, etc.....	655	Lettuce.....	304

	PAGE.		PAGE.
Lice and mites on animals.....	364	Milk and Cream (see Dairy).....	835
Lime as a manure.....	110	Millet.....	129
Liquid manures.....	82	Mink-trap.....	432
Locality of farm.....	20	Money-making on small home-lot.	400
Location of the house.....	379	Muck, how formed.....	95
Locust-growing for timber.....	371	Mule, The.....	676
How to start a plantation.....	374	In America.....	676
Log-holder.....	406	Breeding and breaking.....	678
Log-lifter.....	406	Experience in breeding.....	678
Lot, size of house.....	380	Breaking and managing: kind-	
Louse, Bark, apple-tree.....	346	ness.....	679
Plant.....	350	Will-power and stubbornness..	681
Lucern.....	131	Economy of mule-power.....	682
MANAGEMENT of manures.....	78	Longevity of the Mule.....	683
Managing a small farm.....	399	Winter care of Mules.....	684
Manures.....	105, 73	The Hinny.....	685
How to get the most.....	74	Musk melons.....	304
How to save the most.....	75	NITROGEN in soils, Source of.....	96
Shape of heaps.....	76	Norman Conquest mingles bloods	477
To what crops to apply.....	77	Norman name, The.....	477
Manures for corn.....	152	Nose-jewel to prevent sucking....	411
Market gardening, and its profits.	283	Nutritive qualities of foods.....	1176
Selecting and preparing the		OATS.....	187
garden-spot.....	283	Oats, on what soils.....	188
Laying out the ground.....	285	How to plant.....	188
Crops to be planted.....	286	Onions.....	245
Garden implements.....	286	Soil.....	245
Hot-beds.....	287	How much to plant.....	245
Cold frames.....	288	Garden drag.....	246
When to plant.....	288	Seed.....	246
Insects.....	289	Drill.....	247
Rotation and succession of crops	289	Scuffle-hoe for weeding.....	247
Planting.....	290	Harvesting.....	248
Disposing of garden crops.....	292	Orchard-grass.....	121
Maximum crops only, profitable..	25	Orchard site, Selection of.....	254
May-beetle.....	324	Origin of the soil.....	94
Meadow Fescue.....	122	Out-buildings.....	392
Meadow fox-tail.....	122	Outlet of drain.....	66
Meadows in grass, how long.....	123	PARSNIPS.....	307
Melons, Musk.....	304	Peaches.....	262
Method of preparing manures....	81		
Midge, Wheat.....	325		

	PAGE.		PAGE.
Peach Borer.....	354	Poultry: Chickens—	
Pears.....	263	Poultry-keeping for women.....	1043
Varieties.....	263	Poultry-keeping for boys and	
Blight.....	263	girls.....	1044
Transplanting.....	264	Number of fowls for a farm.....	1044
Dwarf varieties.....	265	Capital needed.....	1044
Peas.....	309	Location of poultry farms.....	1045
Pea-weevil.....	328	Poultry houses.....	1045
Pedigree of Race-horse.....	473	Plans for poultry houses.....	1048
Pedigree seed-corn.....	149	Inside fixtures.....	1052
Peppers.....	310	Yards and fences.....	1055
Percheron Horse, so-called...482,	485	Open roosting-shed for young	
Perennial Rye-grass.....	122	chickens.....	1056
Pests, Farm (see Injurious In-		Movable poultry-fence.....	1057
sects).....	316	Best breeds of fowls.....	1059
Pickles.....	303	Hamburgs.....	1060
Pig-pens (see Swine).....	966	Leghorns.....	1061
Pivot-hinged gate.....	418	Houdans, La Fleche, Black	
Plant-bug, tarnished.....	331	Spanish.....	1062
Planting an Orchard.....	258	Polish.....	1064
Setting the trees.....	259	Bramahs.....	1064
Pruning.....	260	Cochins.....	1065
Cultivation.....	260	Langshans.....	1066
Planting young trees.....	256	Plymouth Rocks.....	1069
Plant-lice.....357,	350	Dominiques.....	1069
Platform for fence-building.....	407	Wyandottes.....	1069
Plow for corn.....	157	Dorkings.....	1069
Plums.....	266	Improve the common fowl.....	1072
Varieties.....	267	Choice of a cock.....	1072
Polled Cattle.....	749	Eggs, or market poultry.....	1073
Ponies.....	531	Management of Laying Hens..	1073
Shetland.....	531	Food and drink.....	1074
Mustang and Indian.....	531	Gravel, oyster-shells, etc.....	1075
Pop-corn.....	301	Best market for eggs.....	1076
Portable fences.....	47	Best prices for eggs.....	1076
Portable shelter.....	429	Packing eggs.....	1077
Post and board fence.....	40	Preserving eggs.....	1078
Plans for making.....	40	Spring chickens.....	1080
Post-holder.....	405	Eggs for hatching.....	1081
Posts, Live fence.....	39	Nests and Sitting Hens.....	1082
Poultry: Chickens—		Egg testers and testing.....	1083
Is poultry-keeping profitable?..	1041	Artificial incubation.....	1084
Poultry on the farm.....	1042	Eclipse Incubator.....	1085

PAGE.	PAGE.
Poultry: Chickens—	Poultry: Their Diseases, and
Care of young chicks.....1086	Remedies therefor.....1119
How to raise Incubator chicks.....1088	Prevention of disease.....1119
Coops and runs for chicks.....1090	“Douglass Mixture” for fowls.....1121
Plans for same.....1091	Care.....1121
Feeding-pens.....1092	Lice, to get rid of.....1121
Marketing spring chickens.....1093	Lice on chicks.....1122
Fall and winter chickens.....1094	Chicken cholera.....1123
Capons.....1094	Roup.....1125
Poultry: Ducks—	Gapes.....1127
Water-fowls: water.....1103	Chills.....1128
Leading varieties.....1104	Cramps.....1129
Pekins.....1104	Scaly legs.....1129
Rouens.....1105	Leg weakness.....1129
Aylesburys.....1105	Rheumatism.....1129
Black Cayugas.....1105	Canker.....1129
Muscovies.....1106	Bumble-foot.....1130
The management of Ducks.....1108	Diarrhœa.....1130
Picking for feathers.....1109	Frost-bites.....1130
Poultry: Geese.....1110	Crop-bound.....1130
Varieties.....1111	Egg-bound.....1131
Toulouse.....1111	Egg broken in oviduct.....1131
Embden.....1111	Apoplexy.....1131
China.....1112	Soft-shelled eggs.....1131
Time of laying.....1112	Egg-eating.....1132
Goslings.....1113	Feather-eating.....1132
Fattening for market.....1113	Moulting.....1132
Picking Geese (see for Ducks).....1114	Obscure diseases of chicks.....1132
Poultry: Turkeys—	Potatoes.....226
Best breeds.....1096	Preparing the soil.....227
Bronze turkeys.....1096	Planting.....228
White Holland.....1098	Cutting the tubers for seed.....229
Feeding, nesting, setting.....1099	Time for planting.....232
Young turkeys cared for.....1101	Covering with straw.....232
Fattening turkeys.....1103	Varieties.....233
Poultry, Preparing for market.....1114	Cultivation.....233
New York law.....1114	Colorado Beetle.....234
Killing fowls.....1115	Harvesting, storing, and mar-
Picking.....1115	keting.....234
Packing.....1116	Implements for digging.....235
Shipping.....1117	Bin for storing.....236
Wild Game-birds.....1117	Pitting.....236
New England rules for poultry.....1118	Potato screen.....413

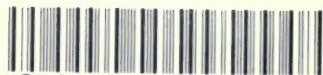
	PAGE.		PAGE.
Preparing soil for corn.....	153	Ringling a hog.....	433
Press, Home-made	434	Roads, convenience to market....	21
Preventives for self-sucking, on		Rock Phosphate.....	111
Cattle.....	428, 410	Roller cover.....	414
Products of farm, Leading.....	23	Root-cutter, Home-made.....	424
Product, The wheat.....	167	Rose-chaffer.....	363
Profitable feeding	1191	Rotation of crops	24
Pulverizing manures.....	79	Rough-stalked Meadow-grass.....	122
Pumpkins.....	200	Rye	190
Purposes of soil.....	97	Straw, its value and uses.....	190
		Can be grown on poor land....	191
QUINCES	267	Prevents soil from washing....	191
		Rye for a green manure.....	90
RACE-HORSE, Pedigree of.....	473		
Rack and manger for cattle or		SADDLE-HORSE, The	509
horses.....	431	Salsify	312
Radishes.....	310	Sand.....	98
Radish-fly.....	339	Sand in garden soils, Using.....	291
Rain-gauge.....	431	Saving seed-corn.....	149
Rape Butterfly.....	338	When to gather it, and how....	150
Raspberries	276	Saw-buck for long wood.....	435
How to manage them.....	277	Saw-fly, Gooseberry	360
Mulching	277	Scare-crows.....	421
Varieties.....	278	Seed-corn.....	148
Ratio of food for young animals..	1185	Seeding to grass.....	124
For milk.....	1186	Selection of farm	18
Rat-trap	433	Selection of varieties of fruit-trees	257
Red clover.....	132	Self-supporting ladder.....	419
Nutritive value	133	Shade-trees about house.....	387
Curing clover-hay.....	134	Shearing-table	423
Time to sow.....	135	Sheep—	
For pasture	136	The Spanish breed, or Merino.	993
Fertilizers for.....	137	Best climate for sheep.....	994
Growing seed.....	137	Mutton.....	995
Testing the seed	138	British sheep-husbandry.....	997
Hoven, clover-bloat, and slob-		Atlantic States for sheep.....	998
bers.....	139	The West.....	999
Red-top (herd's-grass).....	121	Sub-montane District.....	1000
Reducing cost of fences, Mode of.	35	Prairie section.....	1000
Reel, Garden.....	429	Systems of the Far West.....	1001
Rent received for farms.....	32	The Pacific Coast.....	1002
Revolving shelves.....	428	Wool	1002
Rhubarb.....	311	Few diseases among sheep.....	1003

	PAGE.		PAGE.
Sheep—		Shelter, Portable.....	429
Australian sheep-husbandry....	1003	Shelves, Corner.....	435
South America.....	1004	Shipping-box for fowls.....	416
Mexico.....	1005	Shocking-horse.....	408
Cotswold breed.....	1006	Shocking wheat.....	180
Leicester.....	1007	Short-horn Cattle.....	738
Southdown.....	1007	Short-horn Cattle, Characteris-	
Comparison of values.....	1009	tics of.....	743
Breeding the ewe.....	1009	Shrubs and flowers about house..	390
In-and-in breeding.....	1012	Silo, A—	
Time for dropping lambs.....	1012	How to make.....	823
Treatment of ewes in winter...1013		Filling.....	825
Feed during gestation.....	1014	Silos and ensilage.....	821
Roots, and corn-fodder.....	1014	Silt-basins.....	68
Sheep stables.....	1015	Slat shelves.....	428
Tagging.....	1016	Sled-marker for corn.....	155
Lambing.....	1017	Slobbers.....	139
Castration of lambs.....	1020	Slugs, Pear or cherry tree.....	356
Lambs running with the flock.1020		Small farms for poor men.....	395
Care of lambs in winter.....	1021	Snow-plow.....	411
Watering sheep.....	1021	Soil adapted to corn.....	151
Fattening.....	1022	Soil, Condition of.....	20
Sheep for stock and for wool...1024		Soil, Fertility of the.....	93
Washing.....	1026	Sorghum.....	209
Shearing.....	1027	Soil.....	211
Wool-press.....	1028	Cultivation.....	211
The fleece.....	1030	Productiveness.....	212
Ticks.....	1031	Manufacture.....	213
Maggots.....	1031	Spanish (or Texan) Cattle.....	768
Water, change of pasture, win-		Spinach.....	312
ter feeding.....	1032	Squash, Summer.....	312
Salt.....	1032	Winter.....	312
The fly.....	1032	Squash-bug.....	330
Paper-skin.....	1033	Squash-vine Root-borer.....	332
Scald-foot or fowls.....	1034	Stable-barrow.....	436
Toe-shears.....	1034	Stables (see Barn).....	1193
Scab.....	1035	Stacking stage.....	430
Sheep-barns.....	1035	Starch, what composed of.....	1171
Sheep-hook or shepherd's crook.1038		Stock-feeding.....	163
Sheep as scavengers of land...1038		Stock handling—Introduction....	439
Dogs.....	1039	Suggestions and hints.....	440
Sheep-rack.....	421	Stock on high-priced lands.....	442
Shelf, Hanging, Rat-proof.....	425	Views of Chambers Stewart... 442	

	PAGE.		PAGE.
Stock pasturing on the highway...	36	Swine, Breeds of—	
Strawberries.....	272	Poland-chinas.....	948
Soil.....	273	Berkshires.....	951
Culture.....	273	Chester Whites.....	954
Winter protection.....	274	The Essex.....	956
Planting.....	275	Jersey Reds.....	957
Striped-bug.....	331	Suffolks.....	959
Stump-puller.....	412	The Yorkshire.....	961
Success in farming.....	17	The Cheshire.....	961
Sugar, Elements of.....	1171	Lancashires.....	963
Super-phosphate.....	112	Victorias.....	964
Surface draining.....	72	Swine, Housing and Fattening—	
Sward on plow-lands.....	124	Hog houses and pens.....	966
Sweet corn in garden.....	200	Size.....	967
Sweet-scented Vernal grass.....	123	Plans for.....	968
Sweet Potatoes.....	238	Portable pig-pens.....	971
Selecting seed.....	239	House for brood-sows with	
Starting beds for sprouting....	240	stove.....	972
Varieties.....	242	Swill-barrels and troughs.....	973
Preparing soil, planting, and		Cooking food for hogs.....	974
cultivation.....	242	Experience of swine-raisers....	975
Storing.....	245	Green food for hogs.....	977
Swine and their management—		Grass and clover.....	978
First Swine in the West.....	931	Confining hogs.....	979
On “the range”.....	932	Winter care of.....	980
Of no particular breed.....	932	Fattening.....	982
Better breeds introduced.....	933	Feeding, Science of.....	983
Statistics of Swine ..	934	Experiments in.....	986
Who should raise hogs?.....	935	When to fatten.....	987
Improvement of stock.....	935	How much pork from a bushel	
Selection of breeding stock....	937	of corn.....	989
Treatment of the boar.....	938	The hog as a manure-maker ...	990
Sows for breeding, Choosing...	939		
Entering dates.....	939	TAGGING table for sheep.....	422
Caring for the sow and young		Tenants on farms.....	31
pigs.....	940	Testing clover-seed.....	138
Best time for the sow to far-		Tether-pin.....	415
row.....	941	Texas (or Spanish) Cattle.....	768
Profit of litters.....	942	Tile for draining: their size.....	61
Diseases of Swine.....	943	Where to be laid.....	62
Causes of disease.....	944	Tile-hoe or pull-scoop.....	69
Hog cholera.....	944	Timber-growing.....	366
Preventive measures.....	945	Timothy grass.....	120

	PAGE.		PAGE.
Tobacco.....	219	Wagon-jacks.....	403
Varieties	219	War demands for horses, Effect of.	482
Seed and seed-beds.....	219	Water-gap	430, 412
Soil and planting.....	221	Water-gaps and flood-gates.....	50
Worming	222	Water in foods, Influence of.....	1180
Priming.....	222	Water melons.....	306
Topping	223	Water, Pure, for house use.....	393
Suckering.....	223	Water supply of farms	21
Harvesting.....	223	Water-tight box.....	436
Stripping.....	224	Weevil, Pea.....	328
Properties.....	225	Bean.....	329
Tomatoes	313	Wet lands need draining.....	60
Tomato-rack for growing vines...	429	Wet soil, Effect of.....	56
Tomato-worm	333	Wheat	166
Tool-box chair.....	427	Wheat, Barracks for.....	181
Top-dressing grass lands.....	126	Small barn threshers.....	182
Treatment of manures.....	105	Wheat, Clover with.....	185
Trees, Selection of, for fruit.....	255	Wheat-crop, Increase of.....	167
Trees, what to plant.....	368	Wheat, Fertilizers for.....	172
Where to plant.....	369	How and when to sow.....	173
How to plant.....	369	Seeding, thick or thin.....	174
Trimming hedges.....	38	Depth of planting.....	174
Truss fence.....	47	Wheat-growing, Cost of, and	
Ditto, with stakes and wire....	48	profits.....	183
Turkeys (see Poultry).....	1096	Wheat, Harvesting.....	179
Turnips	315, 248	Wheat, Remedy for enemies of..	186
Flat varieties.....	249	Wheat, Soil for.....	168
When to sow.....	249	Drainage.	168
Profits of the crop	250	Preparation of seed-bed.....	169
UNDERDRAINING.....	57	On corn lands.....	171
Use of food	1172	Wheat straw, Value of.....	182
VALUATION of fertilizers.....	113	Wheat, Varieties of	174
Value of corn-fodder.....	159	Clawson	176
Varieties of grass (see Grasses)..	120	Fultz	176
Varieties of Wheat (see Wheat).	176	Silver Chaff.....	177
Vegetables, Description of.....	293	Velvet Chaff.....	177
Ventilators for corn-cribs.....	164	Arnold's Gold-medal.....	177
Ventilators for hay-stacks.....	417	Golden Straw.....	177
WAGES for hired help.....	30	Mediterranean.....	177
Wagon-bed attachment.....	412	Lancaster.....	177
		Zimmerman	178
		Sandomirka.....	178
		Rickenbrode.....	178

	PAGE.		PAGE.
Wheat, Varieties of—		Wheat, Varieties of—	
German Amber.....	178	Finley.....	179
Heige's Prolific.....	178	White clover.....	131
Theiss	178	Wire fences.....	41
York White Chaff.....	178	How to make them.....	42
Rice.....	178	Their cost.....	43
McGhee's Red.....	179	Different styles of.....	44
Tappahannock.....	179	Wire stand or support.....	430
Treadwell.....	179	Wire-worm.....	327
Smith's Improved.....	179	Wood-holder.....	406
Russian No. 2.....	179		
Red Amber	179	YOUNG trees for fruit to be	
Champion Amber.....	179	planted.....	256



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